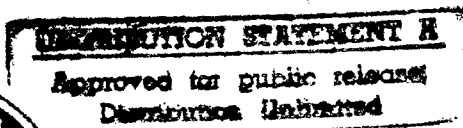


The US Army's Center for Strategy and Force Evaluation

STUDY REPORT
CAA-SR-96-7

**ASSESSMENT OF LOGISTICS AND COST FOR
HAZARDOUS MATERIALS MANAGEMENT
IMPLEMENTATION (ALCHMMI) STUDY**

OCTOBER 1996



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PREPARED BY
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13. ABSTRACT (Maximum 200 words) The ALCHMMI Study identifies and analyzes the costs and benefits associated with implementing the Hazardous Material Pharmacy Concept in the Army. The Army is currently considering how to best implement a centralized hazardous material management system on a Servicewide basis. The Air Force and Navy have reported significant benefits from their respective hazardous material management systems. The ALCHMMI Study looks at the Air Force and Navy systems; identifies their respective strengths and weaknesses; generates and discusses options for implementing the pharmacy concept Armywide; identifies and analyzes the costs and benefits of each option; and lastly, identifies and discusses the impacts on readiness and current logistics streamlining efforts. The ALCHMMI Study was conducted for the Assistant Chief of Staff for Installation Management and the Office of the Deputy Chief of Staff for Logistics.				
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MANAGEMENT IMPLEMENTATION (ALCHMMI) STUDY**

October 1996

Prepared by

RESOURCE ANALYSIS DIVISION

**US Army Concepts Analysis Agency
8120 Woodmont Avenue
Bethesda, Maryland 20814-2797**



REPLY TO
ATTENTION OF:

DEPARTMENT OF THE ARMY
US ARMY CONCEPTS ANALYSIS AGENCY
8120 WOODMONT AVENUE
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CSCA-RA(5-5d)

21 APR 1997

MEMORANDUM FOR

ASSISTANT CHIEF OF STAFF FOR INSTALLATION MANAGEMENT, ATTN:
DAIM-ED-Q, WASHINGTON, DC 20310-0600


DEPUTY CHIEF OF STAFF FOR LOGISTICS, DIRECTOR OF SUPPLY MANAGEMENT,
ATTN: DALO-SPM, WASHINGTON, DC 20310-0500

SUBJECT: Assessment of Logistics and Cost for Hazardous Materials Management
Implementation (ALCHMMI) Study

1. Reference memorandum, DAIM-ED-Q, 30 May 96, Subject: Assessment of Logistics and Costs for Hazardous Materials Management Implementation (ALCHMMI) Study Directive.
2. Referenced memorandum requested the U.S. Army Concepts Analysis Agency (CAA) identify the costs and benefits associated with implementing the Hazardous Material Pharmacy Concept Army-wide.
3. This final report documents the results of our analysis and incorporates any comments on the final draft report that were received. The ALCHMMI Study identifies and analyzes the costs and benefits associated with implementing the Hazardous Material Pharmacy Concept in the Army. Findings reveal that numerous options exist for implementing the Pharmacy Concept in the Army, and that most Army installations should benefit from applying a combination of these initiatives. The ALCHMMI cost/benefit analysis approach is transferable to Army installations and can be used to estimate costs and benefits associated with implementing a combination of the initiatives.
4. CAA expresses appreciation to all staff elements and agencies which have contributed to this study. Questions and/or inquiries should be directed to the Resource Analysis Division, U.S. Army Concepts Analysis Agency, 8120 Woodmont Avenue, Bethesda, MD 20814-2797, DSN 295-6929.

E. B. VANDIVER III
Director

Encl

	ASSESSMENT OF LOGISTICS AND COST FOR HAZARDOUS MATERIALS MANAGEMENT IMPLEMENTATION (ALCHMMI) STUDY	STUDY SUMMARY CAA-SR-96-7
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THE REASON FOR PERFORMING THE STUDY was to identify the costs and benefits associated with implementing the hazardous materials pharmacy concept in the Army.

THE STUDY SPONSORS were the US Army Assistant Chief of Staff for Installation Management (ACSIM) and Office of the Deputy Chief of Staff for Logistics (ODCSLOG).

THE STUDY OBJECTIVES were to:

- (1) Describe how the pharmacy concept has been implemented in the Services and discuss their respective strengths and weaknesses.
- (2) Identify and discuss the options for implementing the pharmacy concept in the Army.
- (3) Identify the costs and benefits of implementing the pharmacy concept in the Army.
- (4) Identify how the pharmacy concept may impact readiness and discuss current logistics streamlining efforts.

THE SCOPE OF THE STUDY

(1) Consider as case studies at least one Air Force and one Navy site with an implemented pharmacy.

(2) Consider a minimum of three Army sites to include at least one each from the US Army Materiel Command (AMC), the US Army Training and Doctrine Command (TRADOC), and the US Army Forces Command (FORSCOM).

THE BASIC APPROACH used in this study was to research the pharmacy concept in other Services and in industry to establish a knowledge base of pharmacy characteristics. Visits to various Navy and Air Force sites were made to determine similarities and differences; strengths and weaknesses; and lessons learned from other Service pharmacies. Army pilot sites were visited to assess how these sites planned to implement the pharmacy concept. Next, environmental, logistics, and installation readiness metrics were selected to measure the costs and benefits of pharmacy implementation across AMC, TRADOC, and FORSCOM. A cost and benefit analysis model was used to conduct the analysis on the monetary metrics. Financial analysis indicators used in this effort were net present value and discounted payback. Analysis on the nonmonetary metrics was also conducted by the study team. A survey of current Army logistics initiatives was conducted as was the potential impacts of implementing the pharmacy concept on these initiatives. A comprehensive investigation of these initiatives was, however, precluded due to the limited time and scope of the study. Issues such as direct vendor deliveries and manhour requirements by units making special supply runs to the pharmacy were not addressed in the scope of this effort.

THE PRINCIPAL FINDINGS of the ALCHMMI Study are:

(1) Most Army installations should benefit from applying a combination of the pharmacy concept initiatives based on the ALCHMMI cost and benefit analysis and observed Service experiences.

(2) The ALCHMMI cost and benefit analysis approach is transferrable to Army installations and can be used to estimate costs and benefits associated with implementing a combination of the pharmacy concept initiatives.

(3) Numerous options exist for implementing the pharmacy concept initiatives in the Army.

(4) Services are actively involved in improving hazardous materials (HM) management.

(5) HM pharmacy initiatives should positively impact readiness and ongoing logistics streamlining efforts.

THE STUDY EFFORT was directed by MAJ William T. Allen, Resource Analysis Division, US Army Concepts Analysis Agency (CAA).

COMMENTS AND SUGGESTIONS may be sent to the Director, US Army Concepts Analysis Agency, ATTN: CSCA-RA, 8120 Woodmont Avenue, Bethesda, MD 20814-2797.

CONTENTS

CHAPTER		Page
1	EXECUTIVE SUMMARY	1-1
	Purpose.....	1-1
	Background	1-1
	Scope.....	1-3
	Objectives	1-3
	Methodology	1-3
	Findings and Recommendations	1-5
2	ANALYSIS AND RESULTS	2-1
	Introduction.....	2-1
	Service Characteristics.....	2-1
	Pharmacy Options for Implementation.....	2-3
	Cost and Benefit Analysis.....	2-6
3	FINDINGS AND RECOMMENDATIONS	3-1
	Introduction.....	3-1
	Findings and Recommendations	3-1
 APPENDIX		
A	Study Contributors.....	A-1
B	Study Directive	B-1
C	Army Hazardous Materials Management Policy	C-1
D	Site Visit Summaries	D-1
E	Description of TurboBPR Model.....	E-1
F	Bibliography	F-1
G	Impact on Logistic Initiatives	G-1
H	Cost and Benefit Analysis Calculations.....	H-1
I	Organizational Level of HM Pharmacy Implementation.....	I-1
J	Assumptions.....	J-1
K	Case Study: Sample Installation	K-1
 GLOSSARY		 Glossary-1

FIGURES

FIGURE		Page
1-1	Pharmacy Concept Analogy	1-2
1-2	ALCHMMI Study Methodology	1-3
2-1	Cost and Benefit Analysis Approach	2-7
2-2	Cost and Benefit Indicators - Monetary	2-8
2-3	Cost and Benefit Indicators - Nonmonetary	2-8
2-4	Cost and Benefit Analysis Key Assumptions	2-10
2-5	Net Present Value: Average TRADOC Site	2-11
2-6	Net Present Value: Average FORSCOM Site	2-12
2-7	Net Present Value: Average AMC Site	2-12
2-8	Discounted Payback Comparison for Average Site	2-12
2-9	Sensitivity to Varying Performance Goals Using Average HW Generation Values for TRADOC, FORSCOM, and AMC, FY 1999	2-15
H-1	Cost and Benefit Analysis Spreadsheet	H-1
I-1	Option 1 - Status Quo	I-2
I-2	Option 2 - HMCC Control	I-3
I-3	Option 3 - HMCC Control and Storage	I-4
I-4	Option 4 - HMCC and Installation Storage	I-5
I-5	Option 5 - Virtual Pharmacy	I-6
K-1	Data Worksheet	K-1
K-2	Sample Installation Updated Spreadsheet	K-2

TABLES

TABLE		
1-1	Site Visit Locations	1-4
2-1	Pharmacy Concept Initiative Alternatives	2-9
2-2	Monetary Cost Indicators (cost impacts) Percentage Breakout	2-10
2-3	Monetary Cost Indicators (benefit impacts) Percentage Breakout	2-11
2-4	Key Performance Measures	2-13
2-5	Initiative Impacts on Performance Measures	2-13
2-6	Nonmonetary and Nonquantified Cost and Benefit Indicator Impacts	2-16
2-7	Nonquantified Impact Comparisons	2-16

TABLE**Page**

J-1	Cost Data Assumptions.....	J-1
J-2	Cost and Benefit Analysis Approach Assumptions	J-2
J-3	Economic Analysis Assumptions	J-3
K-1	Sample Installation Initiatives.....	K-5
K-2	Summary of Cost and Benefit Analysis Results	K-5

ASSESSMENT OF LOGISTICS AND COST FOR HAZARDOUS MATERIALS MANAGEMENT IMPLEMENTATION (ALCHMMI) STUDY

CHAPTER 1

EXECUTIVE SUMMARY

1-1. PURPOSE. The purpose of the ALCHMMI Study was to identify the costs and benefits associated with implementing the hazardous material pharmacy concept in the Army.

1-2. BACKGROUND

a. The term "pharmacy" can be a rather ambiguous and confusing term when used in the context of hazardous materials (HM) or hazardous materials management on a military installation. The study effort determined the term "pharmacy" had different meanings to different people. In its simplest form, an analogy can be made between a pharmacy in the medical community and an HM pharmacy. A hospital has a pharmacy or a centralized location where patient prescriptions can be filled in the appropriate doses for a specific period of time. This same centralized approach can be used for HM management. Figure 1-1 illustrates this comparison. Currently, at some installations, customers may obtain a variety of HM with little or no control over the quantities or types of items. HM can enter an installation in many ways, for example, through the supply system, vendors, credit card purchases, local purchases, and the Defense Reutilization Marketing Office (DRMO). HM are getting onto the installations and into the hands of unauthorized users, and control over HM inventory becomes an issue. A variety of problems may arise such as wasted expenditures, environmental noncompliance, personnel safety and health concerns. The "pharmacy," or HM pharmacy as it will be referred to in this study, attempts to establish centralized management in which HM are issued to authorized users when they need them and in the correct quantities. The HM pharmacy attempts to manage the types of HM that enter an installation; the amounts used and/or dispensed; the persons and activities authorized to use these materials; and the retention period for these materials.

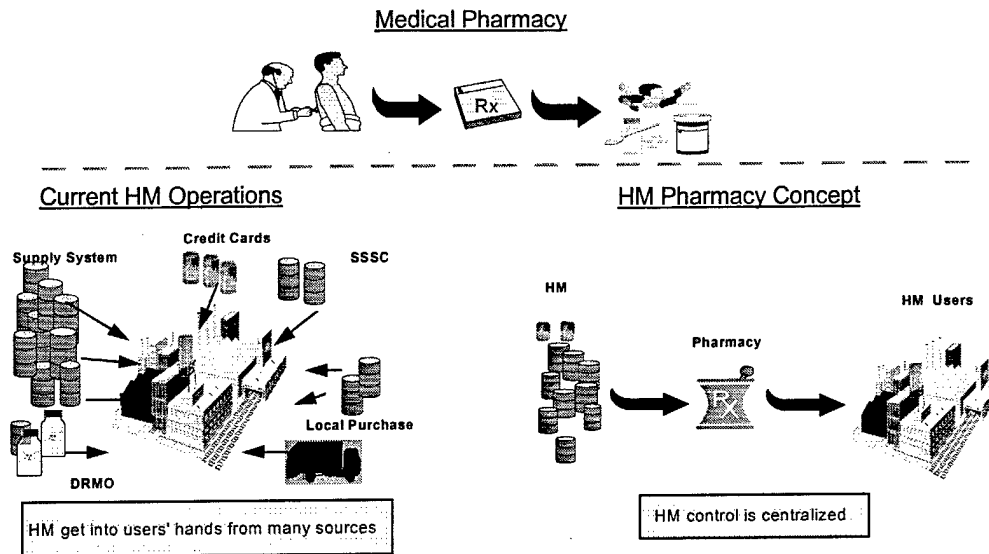


Figure 1-1. Pharmacy Concept Analogy

b. The Navy and Air Force have reported significant cost savings/cost avoidances and pollution prevention successes by implementing an HM pharmacy program to manage their hazardous materials. The Army is considering plans to implement a similar type program Army-wide. In January 1996, the Assistant Chief of Staff for Installation Management (ACSIM), together with the Office of the Deputy Chief of Staff for Logistics (ODCSLOG), sent policy message 221200Z to commanders at the US Army Materiel Command (AMC), US Army Forces Command (FORSCOM), and US Army Training and Doctrine Command (TRADOC) stating the Army's intention to implement an HM pharmacy program (see Appendix C). The US Army Materiel Command, one of Army's largest generators of hazardous waste (HW), was mandated to develop a strategy and milestones for implementing a pharmacy-like method of managing HM by 15 March 1996. FORSCOM and TRADOC were required to submit pilot sites by 15 March 1996.

c. In January 1996, the Assistant Chief of Staff for Installation Management and the Deputy Chief of Staff for Logistics requested that the US Army Concepts Analysis Agency (CAA) conduct an analysis to determine the costs and benefits of implementing an HM pharmacy program for managing HM Armywide. CAA led a study team consisting of representatives from the US Army Environmental Center (AEC), the US Army Center for Health Promotion and Preventive Medicine (CHPPM), and the US Army Logistics Integration Agency (LIA).

d. **Study Sponsors.** ACSIM and ODCSLOG are the study sponsors (the ALCHMMI Study Directive is included in Appendix B).

1-3. SCOPE. The fundamental scope of the ALCHMMI Study is outlined below.

- a. Consider as case studies at least one Air Force and Navy site with an implemented pharmacy.
- b. Consider a minimum of three Army sites, to include at least one each from the US Army Materiel Command, the US Army Training and Doctrine Command, and the US Army Forces Command.

1-4. OBJECTIVES

- a. Describe how the pharmacy concept has been implemented in the Services and discuss respective strengths and weaknesses in each program.
- b. Identify and discuss the options for implementing the pharmacy concept in the Army.
- c. Identify the costs and benefits of implementing the pharmacy concept in the Army.
- d. Identify how the pharmacy concept may impact readiness and current logistics streamlining efforts.

1-5. METHODOLOGY

a. **Overview.** The methodology used to conduct the ALCHMMI Study is illustrated by Figure 1-2. The ordering of the tasks indicates the general sequence of task execution. In some cases, however, tasks were performed simultaneously. For example, site visits and data collection occurred simultaneously, and report documentation was conducted concurrently throughout the methodology.

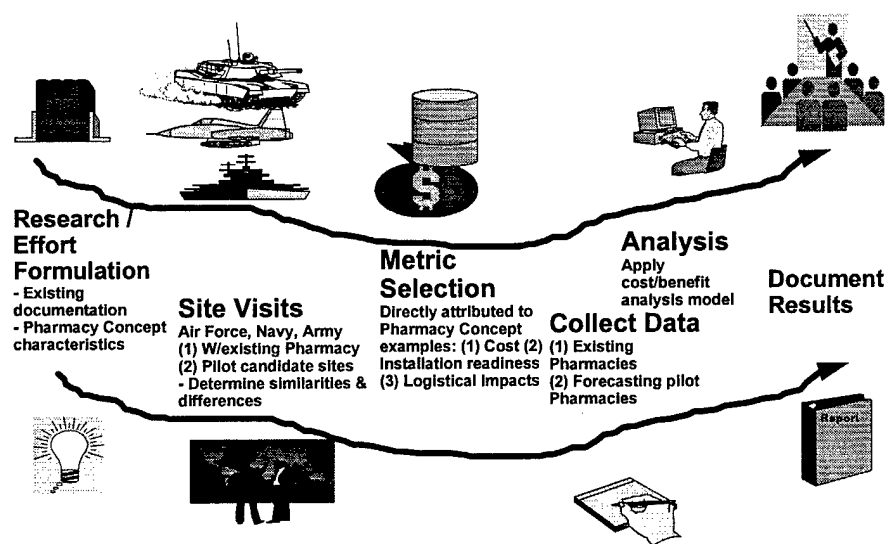


Figure 1-2. ALCHMMI Study Methodology

b. Task 1 - Research/Effort Formulation. The following steps were taken to perform this task: gathering data to define the “pharmacy concept,” describing the procedures of establishing and implementing a pharmacy, identifying the potential stakeholders, customers, and persons/organizations involved in establishing and executing a pharmacy, identifying organizations that would benefit from a pharmacy, and finally, answering the question as to why the pharmacy concept should be used over the current methods of operation. Data were assimilated from a variety of sources. Policy and guidance documents were gathered from the Navy and Air Force as were information papers, newsletters, reports, and the like. Subject areas included pharmacy and pharmacy-related issues, logistics and supply operations, Installation Status Reports (ISRs), and environmental papers. A list of materials used during the conduct of the study is found in Appendix F.

c. Task 2 - Site Visits. The study team visited a total of eight sites. The study team was primarily concerned with establishing a foundation or knowledge base of the pharmacy concept at the initial stages of the study. Site visits were supplemented by research conducted prior to any travel. Team members became more familiar with the pharmacy concept after these visits and were better equipped to ask site representative more focused questions regarding pharmacy operating procedures on subsequent trips. The site visits to Navy Fleet and Industrial Supply Centers (FISC) at San Diego and Norfolk encompassed the Naval Amphibious Base Coronado, Naval Air Station Miramar, USS Kitty Hawk, Oceana Naval Air Station, and Little Creek Naval Base. Appendix D describes in more detail site visits shown in Table 1-1 and HM pharmacy operations at those sites.

Table 1-1. Site Visit Locations

Navy	Air Force	Army
FISC Naval Station at San Diego	Andrews AFB	Corpus Christi Army Depot
FISC Norfolk	Kelley AFB	Fort Campbell
	US Air Force Academy	Fort Eustis

The study team was also able to obtain pharmacy operations information from Fort Knox, Pine Bluff Arsenal, and the 98th Area Support Group in Wuerzburg, Germany.

d. Task 3 - Metric Selection. The study team determined appropriate metrics to measure the effectiveness of the HM pharmacy. After extensive research and several site visits, the team concluded that HW disposal and HM procurement cost avoidances were key indicators of the effectiveness of the HM pharmacy. The cost and benefit indicators utilized in the study are shown in Chapter 3.

e. Task 4 - Data Collection. Data collection occurred throughout the study effort, with the preponderance of data collected during the site visits. The ALCHMMI study team gathered information on major aspects of Navy, Air Force, and Army pharmacy operations. Data included the following: planning and implementation processes; automated systems used to track hazardous material use, generation, consumption, and disposal; lessons learned papers; HW Minimization/Pollution Prevention Plans, HM Implementation Plans, HM Management

Programs; and HW generation data obtained from the Army Compliance Tracking System (ACTS).

f. Task 5 - Analysis. The cost and benefit analysis attempts to estimate the economic impacts for an HM pharmacy. The variations of the numerous pharmacies assessed during the course of the study made it virtually impossible to accomplish the goal of determining precise costs and benefits associated with a "typical" HM pharmacy for Armywide implementation. Upon assessment of data collected in Task 4, the study team defined the HM pharmacy in terms of eight separate initiatives or components. Any combination of these initiatives is indicative of HM pharmacy operations. Monetary and nonmonetary (quantifiable and nonquantifiable) costs and benefits were identified, as were the assumptions used during the study effort. Analysis was conducted on illustrative AMC, FORSCOM, and TRADOC sites using average HW generation data from the ACTS data base. Portions of an existing business process reengineering model (TurboBPR) were used to help perform the economic analysis. Financial indicators used to assess the performance of the pharmacy alternatives were net present value (NPV) and discounted payback. NPV is the present value of a project's future cash flow less the present value of the investment in the project. Sensitivity analysis generated high and low scenarios in addition to the base case scenarios. Details of the cost and benefit analysis are in Chapter 3. The TurboBPR model applications are described in Appendix E. A survey of current Army logistics initiatives was conducted as was the potential impacts of implementing the pharmacy concept on these initiatives. A comprehensive investigation of these initiatives was, however, precluded due to the limited time and scope of the study. Issues such as direct vendor deliveries and manhour requirements by units making special supply runs to the pharmacy were not addressed in the scope of this effort. The ALCHMMI study team also looked at organizational levels within an installation for pharmacy implementation. Details of this analysis are in Appendix I.

g. Task 6 - Report Documentation. Documentation of the study methodology, analysis, and findings are included in this report.

1-6. FINDINGS AND RECOMMENDATIONS. This paragraph highlights the major findings of the ALCHMMI Study.

a. Findings

(1) The Navy, Air Force, and Army are actively involved in improving the effectiveness and efficiency of their HM management.

(2) Several options exist for implementing the pharmacy concept initiatives within the Army.

(3) Most Army installations should monetarily and nonmonetarily benefit from applying some combination of the pharmacy concept initiatives.

(4) The ALCHMMI cost and benefit analysis approach is transferrable to Army installations. Initial estimates of costs and benefits associated with implementation can be made for combinations of the HM pharmacy initiatives.

(5) HM pharmacy initiatives should positively impact readiness and ongoing logistics streamlining efforts.

b. Recommendations

(1) The Army should establish policies to promote and implement HM pharmacy initiatives, as appropriate, throughout the Army.

(2) The Army should provide user-friendly access to the ALCHMMI cost and benefit analysis approach. This would assist installations/major Army commands (MACOMs) in estimating their costs and benefits associated with implementing any combination of pharmacy concept initiatives.

CHAPTER 2

ANALYSIS AND RESULTS

2-1. INTRODUCTION. This chapter discusses three subject areas in the following paragraphs: Service pharmacy characteristics; pharmacy concept options; and cost and benefit analysis and results. The next paragraph, Service Characteristics, discusses general characteristics of the HM pharmacy programs found in the Navy, Air Force, and Army. The following paragraph presents pharmacy concept options. The components which make up a "pharmacy" are identified and briefly discussed. The final paragraph of this chapter describes the cost and benefit analysis and its results.

2-2. SERVICE CHARACTERISTICS. The ALCHMMI study team met with Service representatives who were the catalysts behind the establishment of HM pharmacies within each Service and installation. This was paramount in gaining a better understanding of the business practices associated with centrally managing and controlling HM at diverse installations. This paragraph provides the reader with an overview of the HM pharmacy program as it exists among the Services.

a. US Navy. The Navy was the first of the Services to establish and implement the pharmacy concept on its ships and ashore activities. In May 1995, the Chief of Naval Operations mandated that by 31 May 1998 all afloat and ashore activities establish and achieve Navywide implementation of the Consolidated Hazardous Material Reutilization and Inventory Management Program (CHRIMP). The Naval Supply Command is responsible for CHRIMP implementation. The implementation of CHRIMP excludes submarines because they are self-contained entities in and of themselves and currently have their own procedures for using HM and disposing of HW. As of June 1996, 100 percent of active commissioned ships (all surface ships larger than a fast frigate) have implemented CHRIMP, and 23 percent of ashore activities have begun or implemented this program.

(1) The Navy is well-organized in its approach to implement CHRIMP Navywide. Implementation teams, referred to as "tiger teams," are sent out to sites to help initiate the program. The implementation is flexible and can accommodate specific needs and organizational methods. CHRIMP implementation utilizes a phased approach, focusing on the key elements of command commitment, personnel awareness, and a comprehensive implementation plan. CHRIMP uses specific metrics such as disposal and procurement avoidance quantities to measure their overall progress. The Navy's CHRIMP program parallels their regionalized supply system process in which Navy bases located in close geographical areas operate under the Fleet and Industrial Supply Center. CHRIMP utilizes a hazardous materials center to control and distribute HM. HM is delivered to customers, and unused HM is picked up and made available for reissue. The Navy CHRIMP currently utilizes the Hazardous Inventory Control System (HICS) software to track HM; however, an eventual transition to the Department of Defense (DOD) Hazardous Substance Management System (HSMS) software is in process.

(2) The Navy has achieved much success in implementing their program primarily because of its command-level support, comprehensive implementation plan, strong marketing strategy, and centralized funding. An apparent weakness for the Navy CHRIMP and the other Services is the limited interface between the CHRIMP program and the supply system.

b. US Air Force. The Air Force has been proactive in HM management for at least 10 years. In January 1993, the Air Force Chief of Staff directed the Air Force to become more active in preventing pollution by reducing the use of HM and releases of pollutant into the environment. The Air Force Pollution Prevention Strategy, July 1995, is the guidance that lays out the policy for implementing a program for the management and centralized control of HM usage. The hazardous material (HAZMART) pharmacy has been implemented at all Air Force major commands (MAJCOMs), to include Europe and the Pacific. The Air Force logistics wings have overall supervision for the HAZMART.

(1) The Air Force, like the Navy, is well-organized in its implementation approach. Air Force pharmacy teams are comprised of a cross-section of personnel from the areas of environment, logistics/supply, and health and safety. The Air Force uses a phased approach for implementation, working with one shop at a time. The Air Force also recognized the need to remain flexible to accommodate specific needs and organizational methods. The Environmental Management Information System (EMIS) software is the automated tracking system currently most utilized in the Air Force. A transition to the DOD Hazardous Substance Management System software is also in process.

(2) The Air Force HAZMART program is still challenged with the limited control of credit card purchases by individuals or shops, and by the minimal interface with their current supply system.

c. US Army. The Army is considering worldwide implementation of the pharmacy concept at its installations. In January 1996, ACSIM, together with the ODCSLOG, stated Army intentions to implement a pharmacy-like concept (see Appendix C) in a message sent to commanders at AMC, FORSCOM, and TRADOC. The message stated that all AMC facilities should implement a pharmacy program by 15 March 1996 and that FORSCOM and TRADOC each nominate a prototype installation by the same time. To date, pharmacy implementation has occurred in various stages at Corpus Christi Army Depot, Pine Bluff Arsenal, Fort Knox, Tooele Army Depot, Fort Eustis, Fort Campbell, and the 98th Area Support Group (Wuerzburg, Germany). FORSCOM selected Fort Carson as its pharmacy pilot site, and TRADOC selected Fort Huachuca.

(1) Installations which have implemented the HM pharmacy concept or are in the beginning stages of implementation have found that a phased approach works best. New shops/users should be brought into the process only after the existing ones are under control. Remaining flexible to accommodate specific needs and organizational methods is imperative. The Army will also require that HSMS be the automated system to track HM and HW at each Army installation.

(2) There are many challenges facing the Army as it sets out to establish the pharmacy concept worldwide. Currently, there is neither an Armywide implementation plan nor a comprehensive program/guidance for implementing the pharmacy concept. Other challenges that will be common to most Army installations are a lack of centralized funding for implementation, minimal interface with the supply system, and a lack of control over credit card purchases.

2-3. PHARMACY OPTIONS FOR IMPLEMENTATION. The term “pharmacy” has for some time caused concern within the Army community. First used by the Air Force, the term “pharmacy” was adopted by Army personnel to reflect a type of centralized management and control of HM at installations. To alleviate any concerns or predetermined notions about what the term “pharmacy” means, the ALCHMMI study team has used the term “pharmacy concept” to describe the business process of managing and centrally controlling the ordering, issuing, tracking, storing, and dispensing of HM on an installation. Eight pharmacy concept initiatives were identified after numerous site visit discussions and research. These eight initiatives are a combination of what was observed comprehensively rather than selected from one or two specific installations. These initiatives were the major focus of the pharmacy concept cost and benefit analysis conducted. As stated in the introduction, each pharmacy concept initiative is identified and loosely defined so it can be modified according to the needs of each installation. The initiatives are presented in random order and in no way indicate an order for implementation or level of importance. A description of the eight initiatives and their potential benefits follows.

a. Establish Reuse Procedures

(1) **Description.** Reuse procedures provide for activities to turn in unopened/unused or partially used containers of HM. The material is made available, usually free of charge, to other activities on the installation. This reduces the amount of HW requiring disposal, as well as saving on procurement costs. If partially used containers are accepted, a system to evaluate the quality of the material may be necessary. There are currently regional reuse centers in operation which allow DOD installations, in a designated geographical area, to benefit from other installations’ excess HM. A service charge may be imposed to help fund the reuse operation. If HM is being managed in conjunction with a reuse center, the amount of excess HM should decrease, thus limiting the need for a reuse center and reuse procedures over time.

(2) **Benefits.** Reuse saves on procurement costs and hazardous waste disposal costs by allowing activities to use materials that may otherwise become a waste.

b. Order by Unit of Use versus Unit of Issue

(1) **Description.** This refers to the practice of ordering and dispensing HM in the unit size needed to perform a specific task. In other words, if 3 quarts of oil are needed, then 3 quarts should be ordered rather than a 55-gallon drum. This may require using different national stock numbers (NSN) or negotiating with vendors to purchase smaller units. Ordering and dispensing HM by unit of use may reduce the amount of HW that is generated by minimizing shelf life expirations and raising personnel awareness, thus reducing HW generation.

(2) Benefits. Spills may be reduced because personnel are working with more manageable containers. There is an existing belief that purchasing in bulk is the most cost efficient method of procurement. However, buying/dispensing by unit of use helps reduce waste disposal costs, reduces the potential for regulatory noncompliance fines, and increases worker safety. Smaller units are often available at General Services Administration (GSA) under different NSN, and many vendors will try to provide material in containers of the required size. Some items are more expensive to purchase in smaller containers. However, the aforementioned benefits offset the higher purchase costs.

c. Establish Centralized Issue/Storage Points

(1) Description. A centralized issue/storage point is a location on an installation where HM is processed. HM may be initially received from offpost at this location or it may be received from the installation central receiving point (CRP). Issue/storage points may operate under a main post issue/storage point and service a small population (such as individual activities or select groups of activities). The centralized issue/storage points maintain an inventory of HM to service their customers for a predetermined period of time. They may operate in close proximity to the HM end user.

(2) Benefits. Operating close to the user level could reduce the amount of HM in the shops. Personnel operating the issue/storage point may also become familiar with the HM requirements of their customers which could lead to improved inventory control and service. A centralized issue/storage point can also help to direct materials to where they are needed most, minimizing work stoppages.

d. Establish Centralized Hazardous Material Management Cell

(1) Description. A centralized HM management cell at a minimum should order and track HM. The cell could be staffed by a cross-section of functional experts consisting of personnel from logistics/supply, environmental, and industrial hygiene/safety offices. The size and makeup of the team may vary depending on the installation. There are benefits to locating the team members in the same office, although this is not necessary. In addition, the actual makeup of the staff can be flexible as long as the key players listed above provide input and assistance to the team. The main functions of the HM management cell are to order and track HM for the installation or a select group of customers.

(2) Benefits. A centralized HM management cell facilitates HM tracking by centralizing HM transactions. A multidisciplinary team provides different perspectives and expertise needed to manage the HM program. This helps to ensure that HM is obtained quickly and efficiently and handled, used, and stored safely and in compliance with applicable regulations. The cell can also help direct materials where they are most needed. This can reduce/eliminate work stoppages.

e. Establish Authorized User/Use List (AUL)

(1) Description. An authorized user list identifies who can order, receive, and use HM. To become an authorized user, personnel must receive the training required by the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA). An authorized use list shows which shops or activities have a justifiable need for specific HM. This helps to ensure that only those personnel with a real need for materials have access to them. Typically, the installation industrial hygiene/safety and environmental offices have the final approval authority for both the authorized user list and the authorized use list.

(2) Benefits. The AULs increase personnel awareness of HM. Increasing user awareness decreases waste, reduces spill occurrence, improves worker safety, and assists with pollution prevention substitution efforts. In addition, the AULs impose an added amount of responsibility for the HM on the activity personnel and shops. If HM is being tracked, the AULs help simplify the process.

f. Implement Tracking System

(1) Description. A tracking system allows all HM to be traced from the time of order/receipt until use or disposal. There are several different systems currently in use in DOD. The complexity of the tracking system can be determined by the needs of the installation or activity operating it. Simple systems may consist of a very basic data base, while more complex systems may build items such as AULs, material safety data sheets (MSDS), and reporting forms into the system. Installations may choose to track HM for the entire "life cycle" (order to disposal), or HM may only be tracked from order to issue.

(2) Benefits. A tracking system provides increased data visibility to personnel responsible for HM storage and use. This should enhance inventory and shelf life management, increase mission effectiveness by allowing HM to be used where it is most needed, improve regulatory reporting data, and reduce operating costs (contractual/labor for reporting, and noncompliance fines).

g. Establish Inventory Levels at User/Operator Levels

(1) Description. The overall HM inventory levels can be minimized by determining at the user level how much HM is needed for a given amount of time and only stocking what is needed. This can be done at the shop/activity level, the installation supply level, or both. Historical use data is used to set the inventory level. Although users may initially estimate their HM needs for a given amount of time, it may be necessary to adjust the inventories to meet changing "production" demands or requirements.

(2) Benefits. Establishing user HM inventory levels typically reduces overall volume and required storage space for HM. Additionally, managing the inventory helps to prevent excess hazardous waste by managing material shelf life more effectively.

h. Implement Hazardous Material Training/Awareness Program

(1) Description. Various types of training are essential to the effective management of HM. Personnel storing HM should be trained on management practices such as proper labeling, shelf life management, and storage techniques. Certain training is required by law for nongovernment personnel who handle HM and/or HW. It is strongly recommended that all personnel involved also receive the proper training. It is also critical to maintain records to prove that the training has been completed. The required training may vary depending on the materials used, how they are used, if transportation of HM or HW is required, etc. Regulations that require HM or HW training include the following:

OSHA--Worker Safety in HM/HW Operations

- HAZCOM [29 Code of Federal Regulations (CFR) Part 1910.1200]
- HM in Labs or Chemical Hygiene [29 CFR Part 1910.1450(e), (f), (j)]
- Bloodborne Pathogens [29 CFR Part 1910.1030 (g)(2)]
- HW Operations/Emergencies or HAZWOPER [29 CFR 1910.120 (e), (p), (q)]

EPA--Hazardous Waste (RCRA)

- Accumulating Waste for Less than 90 Days [40 CFR Parts 262.34 (a)(4)/265.16]
- Small Quantity Generator (SQG)[40 CFR Part 262.34 (d)(iii)]
- Treatment, Storage, and Disposal Facility (TSDF) (40 CFR Part 264.16)

Department of Transportation (DOT)--Transportation (49 CFR Subpart H, Parts 172.700-704)

- Person that packages
- Transporter

State/Local Agencies--usually training to operate a facility

(2) Benefits. Training increases HM awareness, leading to more responsible handling of materials which results in reduced employer liability. Increased awareness may also encourage personnel to contribute to pollution prevention HM substitution initiatives and may result in more efficient use of materials which, in turn, may reduce HM procurement.

2-4. COST AND BENEFIT ANALYSIS

a. Introduction. The ALCHMMI study team evaluated the costs and benefits associated with HM pharmacy implementation reported by all the Services. It was determined that a number of the HM management problems resolved by sites with existing pharmacies continued to be problems at most Army sites. The potential for benefit from HM management business practice changes does exist at most Army installations.

(1) The cost and benefit analysis conducted in this study attempted to estimate the economic impacts for an HM pharmacy at a standard Army installation. The variations of the numerous pharmacies assessed during the course of the study made it virtually impossible to satisfy the objective of determining precise costs and benefits associated with a "typical" HM pharmacy for Armywide implementation.

(2) The study team developed an approach in which “generic” pharmacy costs were estimated and positive cost impacts (benefits) were determined based on HW generation amounts. Portions of an existing business process reengineering model software (TurboBPR) were used to help with the economic analysis. This approach was useful for the analysis because it addressed some of the key costs and benefits of the pharmacy concept and allowed for aggregate economic estimates for an “average” TRADOC, FORSCOM, and AMC installation. An average FORSCOM installation, for example, was determined by calculating the average amount of HW generated from FORSCOM installations providing data. The same was done for TRADOC and AMC. The approach also can be useful for future applications because the methodology is transferrable, and individual users can adjust the variables, estimates, and assumptions to tailor a cost and benefit analysis for their particular organization at no (or minimal) cost. The cost and benefit analysis approach should compel potential users to consider, at a minimum, the cost inputs and variables addressed by the study in their consideration of an HM pharmacy at their organization.

b. Cost and Benefit Analysis Approach. The cost and benefit analysis approach used in the study was an attempt to evaluate the costs and benefits of a pharmacy at a generic Army installation based on the amount of HW generated. The analysis is based on the incorporation of the initiatives (business practice changes) discussed in paragraph 2-3 of this report. The cost and benefit analysis approach used for the analysis is shown in Figure 2-1.

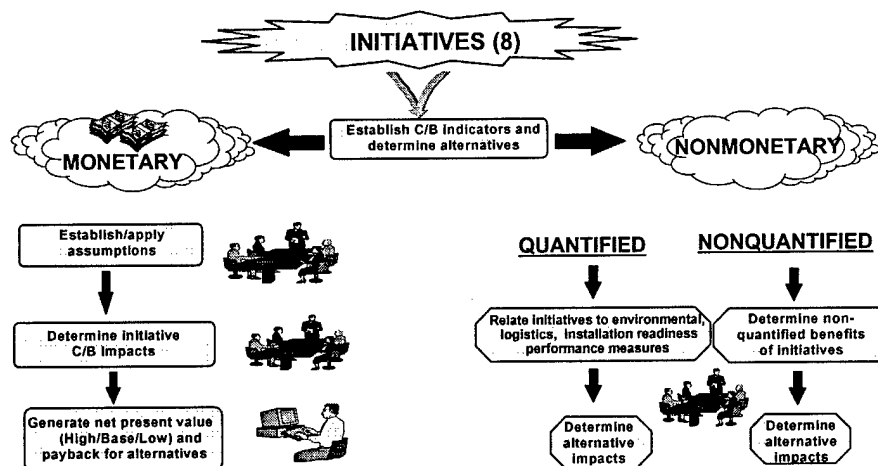


Figure 2-1. Cost and Benefit Analysis Approach

(1) **Cost and Benefit Indicators.** Cost and benefit indicators, or metrics, were determined so the initiatives could be compared and the costs and benefits involved with implementing an HM pharmacy could be evaluated. These cost and benefit indicators (metrics) were selected by the ALCHMMI study team based on the comprehensive research performed and the information provided by the various Service representatives. A list of the monetary cost and benefit indicators is shown in Figure 2-2. Nonmonetary cost and benefit indicators are shown in Figure 2-3. The nonmonetary cost and benefit indicators in Figure 2-3 were all phased as benefits. These indicators were considered costs when the initiative negatively affected the indicator.

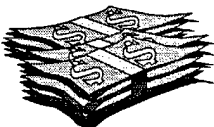
<u>BENEFITS</u>	<u>COSTS</u>	
<ul style="list-style-type: none"> \$ Procurement cost reductions \$ Disposal cost avoidance \$ Inventory and storage cost avoidances \$ Avoided report contracting expenses 	<ul style="list-style-type: none"> \$ ADP \$ Software \$ Supplies (e.g. bar code paper) \$ Initial inventory \$ Training \$ Facility alterations/construction \$ Public relations \$ Staffing \$ Transportation 	

Figure 2-2. Cost and Benefit Indicators - Monetary

<u>QUANTIFIED</u>	<u>NONQUANTIFIED</u>
<ul style="list-style-type: none"> # Reduced HW amounts generated # Reduced inventory amounts # Reduced HM order to ship time (OST) # Improved installation status posture 	<ul style="list-style-type: none"> * Improved personnel health and safety * Increased material substitution * Increased compliance w/ Federal/State/DOD/Army regulations * Improved shelf-life management * Increased organizational integration * Facilitates higher quality reporting data * Improved HM storage environment * Increased personnel awareness

Figure 2-3. Cost and Benefit Indicators - Nonmonetary

As shown in Figures 2-2 and 2-3, the cost and benefit indicators were separated into monetary and nonmonetary categories. The monetary indicators were evaluated in terms of a dollar cost. The nonmonetary quantifiable indicators were those such as the number of pounds of HW requiring disposal. The study team did not attempt to quantify the nonmonetary, nonquantifiable indicators because of their nebulous nature.

(2) Alternatives. As stated earlier, any combination of the eight initiatives could potentially improve overall HM management. The ALCHMMI study team selected three alternatives for the initial analysis. The three alternatives are identified in Table 2-1. Alternative A incorporates all eight of the initiatives. Alternative B is a "bare-boned" version of a pharmacy which incorporates only three of the initiatives. This alternative was selected by the study team for its potential utility at smaller installations. Alternative C, which incorporates five initiatives, was selected as a middle-of-the-road alternative.

Table 2-1. Pharmacy Concept Initiative Alternatives

Initiatives	Alternative A	Alternative B	Alternative C
Establish reuse procedures	✓	✓	✓
Order/disp unit of use vs unit of issue	✓		
Establish centralized issue/storage points	✓		
Establish centralized HM management cell	✓	✓	✓
Establish authorized user/use list	✓		✓
Implement tracking system	✓	✓	✓
Establish inventory levels at user/operation level	✓		
Implement HM training/awareness program	✓		✓

(3) Monetary Cost and Benefit Analysis. The ALCHMMI team used portions of the TurboBPR software model to perform the monetary cost and benefit analysis. A Microsoft Excel spreadsheet was developed to calculate the costs and cost impacts (cost savings/avoidances) for each HM initiative over its economic life. A sample spreadsheet and its equations depicting an average FORSCOM site are included in Appendix H. These costs and cost impacts were imported into TurboBPR. TurboBPR performed the financial indicator calculations. A description of the TurboBPR software methodology is included in Appendix E. The HW amounts reported in the ACTS data base were used as the key input to calculate the cost impacts. ACTS data were used because there was no data available on the HM life cycle cost at Army installations. One consistent observation during all the site visits was that there was no data on the cost of HM management prior to institution of some form of management control (such as pharmacy). Installations that can determine these costs will be able to get better results from this methodology. The site visits and data collected showed that the disposal and procurement avoidances will provide the most significant positive cost impacts. Inventory and storage cost avoidances and report contracting avoidances were also analyzed. DLA storage rate estimates are as high as \$7 per cubic foot for some HW. The ALCHMMI Study took a very conservative approach and used 20 percent of the procurement costs to determine inventory costs. Emergency Planning and Community Right-to-Know Act (EPCRA) report contracting expenses have been increasing in recent years. Installations have reported having to spend over \$60,000 for contractors to complete their required reports. These figures usually do not include installation labor costs incurred in collecting and organizing the data for the contractors.

(4) Assumptions. A series of assumptions based on a Navy business case analysis and data obtained from information collected during site visits was used to calculate and estimate the total cost impacts from cost and benefit indicators. The equations used for these calculations and estimates are shown in Appendix H. The key cost and benefit analysis assumptions are shown in Figure 2-4. These assumptions were established from specific sources or study team decisions. A list of these assumptions and their corresponding sources appear in Appendix J.

- Study team established the percent breakout of costs and cost savings/avoidances among the initiatives (e.g., 70 percent of total ADP costs were designated to Initiative #6: Implement Tracking System)
- Army Compliance Tracking System HW generated (lbs) is used
- 10 percent decrease in annual procurement cost savings/avoidances and 10 percent decrease in annual disposal cost savings/avoidances begin after 3 years
- 40 percent of HW currently disposed is excess/reusable material
- Ratio of 2:3 exists between procurement and disposal cost savings/avoidances
- A 2.8 percent real discount rate is used
- \$2.00/lb disposal cost avoidance factor is used
- 10-year economic life is used for all initiatives
- A linear relationship of cost and cost savings/avoidance impacts is used among initiatives
- Inventory and storage costs are 20 percent of total procurement costs

Figure 2-4. Cost and Benefit Key Assumptions

(5) Determination of Initiative Cost and Benefit Impacts. The study team established percent breakouts to estimate the cost and benefit indicator impacts for each of the eight initiatives. These estimates were determined by reviewing historical data of the sites with existing pharmacies. The transferability aspect of the analysis does allow for these breakouts to be adjusted as appropriate. The percentage breakouts for the monetary cost and benefit indicators are shown in Tables 2-2 and 2-3. Installations or users can assess these figures for their specific situations.

Table 2-2. Monetary Cost Indicators (cost impacts) Percentage Breakout

Initiatives	Facilities	Staffing	Training	Public relations	Transportation	ADP/hardware	Software	Supply
Establish reuse procedures	20%	5%		20%	20%			
Order/disp unit of use vs unit of issue		5%			20%			20%
Establish centralized issue/storage points	80%	35%			60%	15%	15%	20%
Establish centralized HM management cell		35%	10%	80%		15%	15%	20%
Establish authorized user/use list		5%						
Implement tracking system		5%	10%			70%	70%	20%
Establish inventory levels at user/operation level		5%						
Implement HM training/awareness program		5%	80%					20%

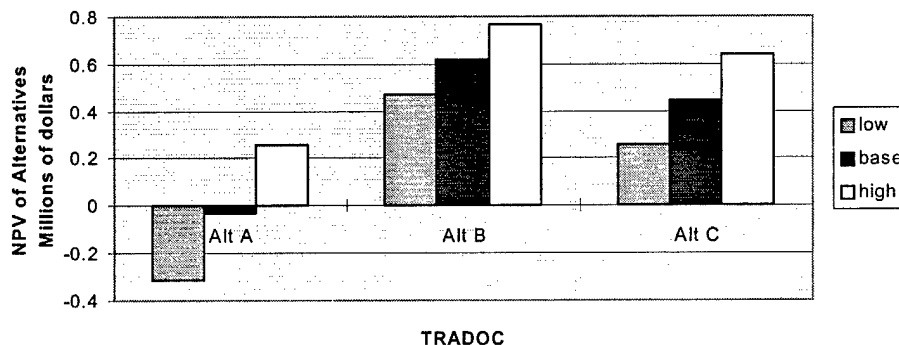
Table 2-3. Monetary Cost Indicators (benefit impacts) Percentage Breakout

Initiatives	Procurement avoidance	Disposal avoidance	Inventory avoidance	EPCRA report contracting
Establish reuse procedures	20%	30%	16.7%	0%
Order/disp unit of use vs unit of issue	0%	15%	16.7%	0%
Establish centralized issue/storage points	0%	0%	0%	0%
Establish centralized HM management cell	20%	15%	16.7%	33.3%
Implement authorized user/use list	10%	0%	16.7%	0%
Implement tracking system	20%	15%	0%	66.7%
Establish inventory levels at user/operation level	20%	15%	33.3%	0%
Implement HM training/awareness program	10%	10%	0%	0%

(6) Calculate Financial Indicators

(a) The essence of the economic analysis process was the ability to compare two or more alternatives. This should provide a valuable tool for decision makers in assessing their HM management alternatives. The alternatives were assumed to have the same economic life and an NPV comparison was used to compare the cost effectiveness of a potential alternative. As stated earlier, the definition of NPV is the present value of a project's future cash flow less the present value of the investment. In this effort, the cost impacts (cost savings/avoidances) were negative values as shown in the Microsoft Excel spreadsheet in Appendix H. These cost impacts were then imported into the TurboBPR model. The TurboBPR model calculated the NPV for each alternative. TurboBPR generates a positive NPV when the alternative is an economically sound investment and a negative NPV when the alternative actually loses money over its economic life. The algorithms used by TurboBPR are described in Appendix E. The discounted payback calculation was used as a second financial indicator to assist in the comparison of the alternatives. This indicator determines the number of years over which the cumulative discounted benefits (in discounted constant dollars) offset the cumulative costs (in discounted constant dollars).

(b) Since cost and performance may vary within a range of values, their representation by only the most likely outcomes is an approximation without a context. TurboBPR allowed the study team to use the most likely outcome, along with the highs and lows of the cost and performance ranges, to estimate continuous risk-adjusted cost and performance distributions. TurboBPR allowed the study team to enter a base case and then evaluate high and low values for each initiative investment costs and performance impacts. The number entered for the high percentage represents the upper bound in terms of variance from the most likely (base case) values entered. The results of the economic analysis are shown in Figures 2-5 to 2-8.

**Figure 2-5. Net Present Value: Average TRADOC Site**

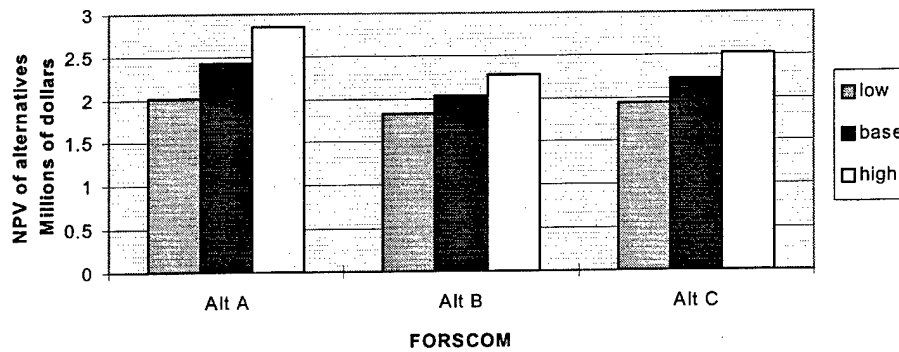


Figure 2-6. Net Present Value: Average FORSCOM Site

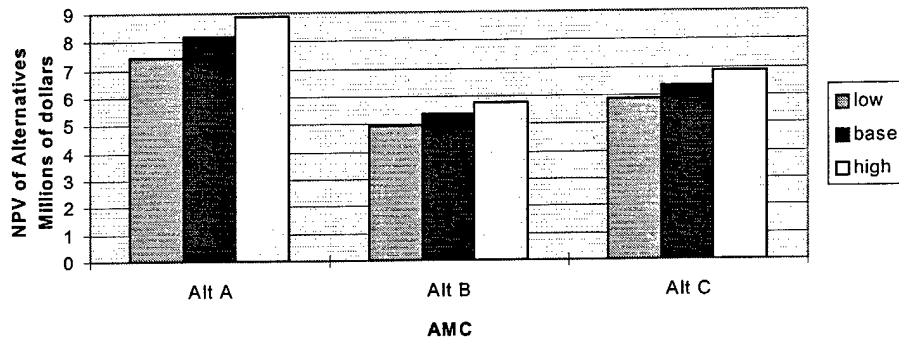


Figure 2-7. Net Present Value: Average AMC Site

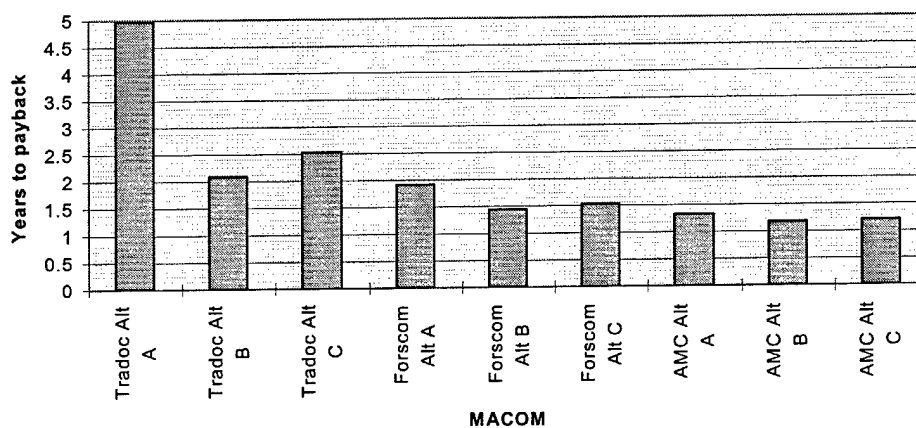


Figure 2-8. Discounted Payback Comparison for Average Site

(7) Nonmonetary Cost and Benefit Analysis. The nonmonetary cost and benefit indicators shown in Figure 2-3 are evaluated next. The approach (shown in Figure 2-1) for the nonmonetary quantified and the nonmonetary nonquantified are discussed in the following paragraphs.

(8) Nonmonetary Quantified Analysis. Nonmonetary quantified indicators are evaluated in this paragraph. These indicators were divided into the three categories: environmental, logistical, and installation readiness based on the study objectives. These categories are discussed further in this paragraph of the report. The key performance measures considered by the study team, for these categories, are listed in Table 2-4.

Table 2-4. Key Performance Measures

Category	Performance measure	Units of measurement
Environmental	HW generation	Lbs
Logistics	- Inventory level	- Lbs
	- Order to ship time (OST)	- Days
Installation readiness	- Installation Status Report (ISR) Part I standards	- Percent of standards impacted
	- Installation Status Report (ISR) Part II standards	- Percent of standards impacted

These key performance measures were again evaluated by using some of the capabilities of the TurboBPR model. A series of goals was established by the study team to assess the performance measure impact of the various alternatives. The ALCHMMI study team determined how each initiative would impact the performance measure goals. Performance goals of 50 percent, 33, percent, and 25 percent were selected to conduct a sensitivity analysis. The 50 percent goal was obtained from Executive Order 12856, Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements, stating a 50 percent HW generation reduction goal for 1999. The 33 percent goal was an established order-to-ship time goal for 1998. The 25 percent goal was selected randomly. The initiatives that positively impact the performance measure are identified in Table 2-5 with a "Y". Determining which initiatives impact on performance measures was done subjectively by the ALCHMMI study team. An example of the rationale for Initiative 6 (Implement a Tracking System) is as follows. This initiative will positively affect HW generation reduction and ISR Part II standards. The ability to know where HM is located should help reduce the occasions in which unnecessary HM is ordered. This should result in HW generation reductions. This initiative also impacts positively on the large number of the ISR Part I standards requiring installations to track their HM. The study team determined that this initiative would not significantly impact inventory level reduction, order to ship time, and ISR Part I standards.

Table 2-5. Initiative Impacts on Performance Measures

Initiatives	HW generation reduction	Inventory level reduction	Order to ship time	ISR Part I	ISR Part II
Establish reuse procedures	Y	Y	N	N	Y
Order/disp unit of use vs unit of issue	Y	Y	N	N	Y
Establish centralized issue/storage points	N	N	Y	N	Y
Establish centralized HM management cell	Y	Y	N	N	Y
Establish authorized user/use list	N	Y	N	N	Y
Implement tracking system	Y	N	N	N	Y
Establish inventory levels at user/operation level	Y	Y	N	N	Y
Implement HM training/awareness program	Y	N	N	N	Y

The initiative's impact on these performance measures was then calculated for selected baseline and goal years. The transferability aspect of the approach allows for the baseline and goals to be modified for future applications. The equations used to calculate the initiative impacts and their results are shown in Appendix H. The baseline and goal year results were imported into TurboBPR, where the model performed the calculations to determine if the performance measure goals were achieved.

(a) Environmental. The performance measure of HW generation evaluated how much an alternative would reduce the HW amount on an annual basis. This performance measure is a key environmental measure based on Executive Order 12856.

(b) Logistics. The impact on current logistic initiatives was also addressed. The performance measures evaluated by the team were those of inventory level impacts and OST. These performance measures were determined by the ALCHMMI study team to be essential to the implementation of the current logistic initiatives: Army Total Asset Visibility (ATAV), Velocity Management (VM) and Total Army Inventory Management (TAIM). The potential impact of the pharmacy concept on these initiatives is discussed in further detail in Appendix G.

(c) Installation Readiness. The study team also addressed the issue of unit readiness. To evaluate this issue, the study team selected the ISR affected standards as a performance measure. This technique was very subjective. It attempted to look at the standards associated with the ISR and determine if the initiatives would have a positive impact. It did not take into account that an installation or an organization might have already achieved their goal for that particular standard without the use of the HM pharmacy initiatives. The ISR sections evaluated were ISR Part I (Facilities) and ISR Part II (Environmental). The results of the analysis are shown in Figure 2-9.

(d) Results. The TurboBPR model generated the results shown in Figure 2-9. As an example, to determine whether or not Alternative B meets the 50 percent, 33 percent, and 25 percent performance goals of decreasing HW generated, the following steps were performed using data from an average FORSCOM installation.

1. Initiatives comprising Alternative B were identified.

Establish reuse procedures
Establish centralized HM management cell
Implement tracking system

2. The performance impact amount for HW generated was identified for each initiative (instructions for the performance impact calculations are described in Appendix H, paragraph H-1a(7)).

Establish reuse procedures	- 63.4K pounds
Established centralized HM management cell	- 31.7K pounds
Implement tracking system	- 31.7K pounds
Total	-126.8K pounds

3. These impacts were then added to the total amount of HW generated at an average FORSCOM installation; in this example, that number is 528K pounds. Based on the impacts of these three initiatives, the HW generated for FY 1999 is estimated to be 401.2K pounds.

$$528 + (-126.8) = 401.2\text{K pounds}$$

4. The value of -126.8K pounds does not achieve the 50 percent (-264K pounds), 33 percent (-176K pounds), or 25 percent (-132K pounds) reduction for HW. Therefore, the TurboBPR model generated "No" in these cases.

Quantified Impacts (performance goals)	Status quo	Alternative A	Alternative B	Alternative C
50% Decrease in HW generated (Environmental)	No	No	No	No
50% Reduction in inventory level (Logistics)	No	No	No	No
50% Decrease in order to ship time (1998) (Logistics)	No	Yes	No	No
50% Percent of ISR Part I standards positively impacted	No	No	No	No
50% Percent of ISR Part II standards positively impacted	No	Yes	Yes	Yes

Quantified Impacts (performance goals)	Status quo	Alternative A	Alternative B	Alternative C
33% Decrease in HW generated (Environmental)	No	Yes	No	No
33% Reduction in inventory level (Logistics)	No	No	No	No
33% Decrease in order to ship time (1998) (Logistics)	No	Yes	No	No
33% Percent of ISR Part I standards positively impacted	No	No	No	No
33% Percent of ISR Part II standards positively impacted	No	Yes	Yes	Yes

Quantified Impacts (performance goals)	Status quo	Alternative A	Alternative B	Alternative C
25% Decrease in HW generated (Environmental)	No	Yes	No	Yes
25% Reduction in inventory level (Logistics)	No	No	No	No
25% Decrease in order to ship time (1998) (Logistics)	No	Yes	No	No
25% Percent of ISR Part I standards positively impacted	No	No	No	No
25% Percent of ISR Part II standards positively impacted	No	Yes	Yes	Yes

Figure 2-9. Sensitivity to Varying Performance Goals Using Average HW Generation Values for TRADOC, FORSCOM, and AMC (FY 1999)

(9) **Nonmonetary Nonquantified Analysis.** The nonmonetary nonquantified indicators were the cost and benefit indicators that the study team did not attempt to quantify because of their nebulous nature. Based on the study team's assumptions, the initiatives that would potentially have a positive impact on the nonmonetary nonquantified cost and benefit indicators were identified with a "Y." The results of the study teams assessments are shown in Table 2-6. The initiative impacts on nonmonetary nonquantified cost and benefit indicators was subjectively determined by the ALCHMMI study team. An example of the study team rationale for one of the initiatives (implementing a tracking system) is described in this paragraph. Implementing a tracking system should help improve personnel health and safety because it should enable organizations to know where and in what quantities HM are located. Appropriate precautions can then be taken. Knowing the quantities and location of HM should help make compliance

with Federal, State, and DOD regulations easier as well as creating higher quality report data and increasing HM substitution. Storage environments for HM could be positively impacted by implementing this initiative because of the ability to identify similar stockpiles of HM that could require specific storage requirements. The study team concluded that this initiative would not have any significant impact on improving shelf life management, increasing organization integration, and increasing personnel awareness.

Table 2-6. Nonmonetary and Nonquantified Cost and Benefit Indicators Impacts

Initiatives	Improved personnel health & safety	Increased HM substitution	Increased compliance with fed/state/ DOD regulations	Improved shelf life management	Increased organized integration	Facilitates higher quality report data	Improve HM storage environment	Increased personnel awareness
Establish reuse procedures	N	N	N	Y	N	Y	Y	Y
Order/disp unit of use vs unit of issue	Y	N	N	Y	N	N	Y	N
Establish centralized issue/storage points	Y	N	N	Y	N	Y	Y	N
Establish centralized HM management cell	Y	Y	N	Y	Y	Y	Y	Y
Establish authorized user/use list	Y	Y	Y	N	N	Y	Y	Y
Implement tracking system	Y	Y	Y	N	N	Y	Y	N
Establish inventory levels at user/operation level	Y	N	N	Y	N	N	Y	Y
Implement HM training/awareness program	Y	Y	Y	Y	Y	Y	Y	Y

The alternatives then were evaluated. If the initiatives in the alternative had any positive impact on the nonmonetary and nonquantified cost and benefit indicator, it was given a "Y" positive impact score. The results of this analysis are shown in Table 2-7.

Table 2-7. Nonquantified Impact Comparisons

Nonquantified impacts	Status quo	Alternative A	Alternative B	Alternative C
Improved personnel health & safety	No	Yes	Yes	Yes
Increased material substitution	No	Yes	Yes	Yes
Increased compliance with Federal/ State/DOD/Army regulations	No	Yes	Yes	Yes
Improved shelf life management	No	Yes	Yes	Yes
Increased organizational integration	No	Yes	Yes	Yes
Increased quality of reporting data	No	Yes	Yes	Yes
Improved HM storage environment	No	Yes	Yes	Yes
Increased personnel awareness	No	Yes	No	Yes

CHAPTER 3

FINDINGS AND RECOMMENDATIONS

3-1. INTRODUCTION. This chapter provides a discussion of the study's key findings and recommendations.

3-2. FINDINGS

a. The Navy, Air Force, and Army are actively involved in improving the effectiveness and efficiency of their HM management. The Navy and Air Force have reported significant cost savings/cost avoidances and pollution prevention successes associated with their HM pharmacies. One hundred percent of all active commissioned ships which are classified as fast frigate or larger (except submarines) and 23 percent of Navy ashore activities have implemented CHRIMP. The HAZMART program has been implemented at all Air Force MAJCOMs, to include Europe and the Pacific. In January 1996, the Army began implementing the pharmacy concept at all AMC installations and at selected FORSCOM and TRADOC pilot test sites.

b. Several options exist for implementing the pharmacy concept initiatives within the Army. This study attempted to determine the costs and benefits associated with an HM pharmacy. During the course of the site visits and research, it was determined that the existing HM pharmacies evaluated were unique entities. The pharmacy concept business processes were tailored to meet the specific needs of the various installations and organizations. This made it difficult to analyze a potential "generic" HM pharmacy that could be used Armywide. The study team looked at the common business practice changes utilized in most of the HM pharmacies and established eight initiatives as the basis for its analysis. Any combination of these eight initiatives, described in Chapter 2, would help overall HM management at an Army installation or organization.

c. Most Army installations should benefit from applying some combination of the pharmacy concept initiatives. The analysis performed in the study showed that most installations should benefit both monetarily and nonmonetarily. A negative NPV only appears for an average TRADOC site when using the low range and base case calculations. All evaluated alternatives positively impact on the majority of the nonmonetary nonquantifiable indicators of cost and benefit. The results of this analysis appear in Chapter 2.

d. The ALCHMMI cost and benefit analysis approach is transferrable to Army installations and can be used to make initial estimates of costs and benefits associated with implementing combinations of the HM pharmacy initiatives. The cost and benefit analysis approach is described in Figure 2-1. The approach utilizes portions of the TurboBPR (as defined in Chapter 2) to conduct the economic analysis. The approach is transferrable, and individual users can adjust the variables, estimates, and assumptions to tailor a cost and benefit analysis for their specific needs. An example of the transferability aspect is demonstrated with an installation case study example in Appendix K.

e. HM pharmacy initiatives should positively impact readiness and ongoing logistic streamlining efforts. The HM pharmacy initiatives tend to complement rather than negatively impact current logistics streamlining efforts. A more complete review by the logistic initiative experts may be required during any implementation effort to minimize adverse impacts. HM pharmacy initiatives also tend to improve installation readiness. This was measured by evaluating the initiative impacts on the ISR standards.

3-3. RECOMMENDATIONS

a. The Army should establish policies to promote and implement HM pharmacy initiatives, where appropriate, throughout the Army. The establishment of an implementation policy should greatly assist Army installations currently searching for assistance and guidance on how best to manage their HM.

b. The Army should provide access to the ALCHMMI cost and benefit analysis approach to assist installations/MACOMs in estimating costs and benefits associated with implementing any combination of pharmacy concept initiatives. This cost and benefit analysis approach can be a useful first step for installations and organizations in deciding what course of action to pursue. The approach enables users to conduct a simple assessment of some of the critical factors and variables that must be considered early on in the decision making process. This approach should not be the sole basis for an HM management decision. The ALCHMMI study spreadsheets should be modified based on specific installation information. The study objective was to assess HM pharmacy cost and benefits for the Army. Some study assumptions might not be applicable to each individual installation.

APPENDIX A
STUDY CONTRIBUTORS

A-1. STUDY TEAM

a. Study Director

MAJ William T. Allen, Resource Analysis Division

b. Team Members

Ms. Vas Mantzouranis, CAA
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Mr. Ben Torreon, CHPPM
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c. Other Contributors

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A-2. PRODUCT REVIEW BOARD

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Mr. Mark Clements
CPT(P) Matthew G. Chesney

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Andrews Air Force Base

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Mr. Robert Tomlinson
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Mr. David Smith

Mr. Danny Eichers

US Army Cost and Economic Analysis Center

Ms. Monteza Anuari

Ms. Betty Weber

APPENDIX B

STUDY DIRECTIVE



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
ASSISTANT CHIEF OF STAFF FOR INSTALLATION MANAGEMENT
600 ARMY PENTAGON
WASHINGTON DC 20310-0600



30 MAY 1996

DAIM-ED-Q

MEMORANDUM FOR DIRECTOR, US ARMY CONCEPTS ANALYSIS AGENCY,
ATTN: CSCA-RA, 8120 WOODMONT AVENUE,
BETHESDA, MD 20814-2797

SUBJECT: Assessment of Logistics and Cost for Hazardous
Materials Management Implementation (ALCHMMI) - Study
Directive

1. PURPOSE OF STUDY DIRECTIVE. This directive tasks the US Army Concepts Analysis Agency (CAA) to identify the costs/ benefits associated with implementing the Hazardous Material Pharmacy concept in the Army.
2. STUDY TITLE. Assessment of Logistics and Cost for Hazardous Materials Management Implementation (ALCHMMI).
3. BACKGROUND. The Army is considering whether or not to implement the Pharmacy concept Army-wide. The Air Force and the Navy report significant benefits from their respective hazardous material management systems. The Army wants to ensure the Pharmacy Concept will be applicable for Army use without any degradation in readiness.
4. STUDY SPONSOR. The Assistant Chief of Staff for Installation Management and the Deputy Chief of Staff for Logistics are the study sponsors. Mr. George Carlisle, DAIM-ED-Q, and Ms. Regina George, DALO-SMP, will serve as the sponsors' representatives.
5. TERM OF REFERENCE.
 - a. Purpose. The purpose of the study is to identify the cost/benefits associated with implementing the Hazardous Material Pharmacy Concept in the Army.
 - b. Scope.
 - (1) Consider as case studies at least one Air Force and Navy site with an implemented Pharmacy.

DAIM-ED-Q

SUBJECT: Assessment of Logistics and Cost for Hazardous
Materials Management Implementation (ALCHMMI) - Study
Directive

(2) Consider at least three potential Army sites from the US Army Material Command (AMC), the US Army Training and Doctrine Command (TRADOC), and Forces Command (FORSCOM).

c. Objectives.

(1) Describe how the Pharmacy Concept has been implemented in the Services and discuss their respective strengths and weaknesses.

(2) Identify and discuss the options for implementing the Pharmacy Concept Army-wide.

(3) Identify the costs and benefits of implementing the Pharmacy Concept in the Army.

(4) Identify how the Pharmacy concept may impact readiness and discuss current logistics streamlining efforts.

6. RESPONSIBILITIES.

a. The study sponsors will:

(1) Provide a study point of contact (POC).

(2) Assist in providing CAA with available data and POCs as required.

(3) Prepare analysis of study results IAW AR 5-5, Army Studies and Analyses.

(4) Provide funds as required to support the conduct of the study.

b. The study agency, CAA will:

(1) Designate a study director and establish a full-time study team.

(2) Establish direct communication with HQDA and other organizations required for the conduct of the study.

DAIM-ED-Q

SUBJECT: Assessment of Logistics and Cost for Hazardous
Materials Management Implementation (ALCHMMI) - Study
Directive

(3) Provide in-process reviews as required and a final
study report to the study sponsor.

7. ADMINISTRATION.

a. CAA will provide all administration support necessary for
the conduct of the study.

b. Milestone schedule:

Approval of Study Directive	May 1996
In-Process Reviews	As required
Present Study Results	June 1996
Publish Final Report	October 1996

c. CAA will submit the final, approved study report to
Defense Technical Information Center (DTIC).

d. CAA will provide study report to the study sponsors as a
study report.

e. This tasking directive has been coordinated with CAA IAW
paragraph 4, AR 10-38, United States Army Concepts Analysis
Agency.



J.C. MENIG
Deputy Assistant Chief of Staff
for Installation Management



A. DAVID MILLS
Director of Supply
Management

APPENDIX C

ARMY HAZARDOUS MATERIALS MANAGEMENT POLICY

OPERATIONS
SUPPORT DIRECTORATE

ROUTINE
R 221200Z JAN 96
FM DA WASHINGTON DC//DALO-ZA/DAIM-ZA//
TO CDRAMC ALEXANDRIA VA//AMCCG//
CDRFORSCOM FT MCPHERSON GA//AFCG//
CDRTRADOC FT MONROE VA//ATCG//
INFO AIG 7406
ZYUW RUEADWDO680 0232044
DA WASHINGTON DC//DALO-SMP//

UNCLAS

SUBJECT: HAZARDOUS MATERIALS MANAGEMENT

1. IT IS ARMY POLICY TO CONTROL AND MINIMIZE THE USE OF HAZARDOUS MATERIALS (HAZMAT). THIS IS A CRITICAL ELEMENT OF THE ARMY POLLUTION PREVENTION PROGRAM AND IS OF THE UTMOST IMPORTANCE IN REDUCING UNNECESSARY COSTS AND IN PROTECTING THE ENVIRONMENT.
2. BOTH THE AIR FORCE AND NAVY HAVE REPORTED SIGNIFICANT COST SAVINGS AND POLLUTION PREVENTION SUCCESS BY IMPLEMENTING THE PHARMACY APPROACH TO HAZMAT MANAGEMENT. SEVERAL ARMY INSTALLATIONS, INCLUDING EUSTIS CHRISTI AND TODELE ARMY DEPOTS, PINE BLUFF ARSENAL, AND FORTS CORPUS AND KNOX HAVE ALSO ALREADY IMPLEMENTED THIS APPROACH TO HAZMAT MANAGEMENT. PHARMACY CONTROL GENERALLY INCLUDES THE FOLLOWING ELEMENTS: CENTRALIZED HAZMAT ORDER, ISSUE, STORAGE, AND DISPOSAL; DISTRIBUTION OF HAZMAT ONLY TO AUTHORIZED USERS AND IN QUANTITIES LIMITED TO IMMEDIATE OPERATIONAL NEEDS; TRACKING HAZMAT THROUGHOUT ITS LIFE CYCLE AT THE FACILITY; AND, COLLECTION AND REISSUE OF UNUSED AND SERVICEABLE HAZARDOUS MATERIALS ON A FREE-ISSUE BASIS.
3. THE ARMY INTENDS TO MOVE TO WORLDWIDE IMPLEMENTATION OF PHARMACY-LIKE CONTROL OF HAZMAT IN A RAPID, YET PRACTICAL MANNER. THE AIR FORCE AND NAVY HAVE DEMONSTRATED THEIR LARGEST SUCCESSSES WITH THE PHARMACY CONCEPT IN INDUSTRIAL-TYPE ACTIVITIES. IN A SIMILAR APPROACH, THE U.S. ARMY MATERIEL COMMAND (AMC) INSTALLATIONS OFFER THE MOST IMMEDIATE BENEFITS FROM IMPLEMENTATION OF THE PHARMACY CONCEPT TO CONTROL HAZMAT PROCESSES; I.E., APPROXIMATELY 80 PERCENT OF THE TOTAL RESOURCES EXPENDED ON HAZMAT IS WITHIN THOSE INSTALLATIONS. TO MEET BOTH THE SPIRIT AND INTENT OF THE DOD HAZMAT STRATEGY, AMC WILL NOTIFY THE ACSIM POC IN PARA 6 BELOW NLT 15 MAR 96 OF MILESTONES FOR ESTABLISHING THE PHARMACY CONCEPT AT ALL FACILITIES. FACILITIES NOT OPERATING AN APPROVED CORPORATE INFORMATION MANAGEMENT MIGRATION SYSTEM WILL ADOPT THE HAZARDOUS SUBSTANCES MANAGEMENT SYSTEM (HSMS). FACILITIES OPERATING THE DEPOT MAINTENANCE - HAZARDOUS MATERIALS MANAGEMENT SYSTEM (DM-HMMS) SHOULD CONTINUE WITH THAT SYSTEM UNTIL AN INTEGRATED HSMS IS FIELDED. POC FOR OBTAINING HSMS IS MR. STAN CHILDS, ARMY ENVIRONMENTAL CENTER, DSN 584-1226.
4. AN OPPORTUNITY TO COLLECT INFORMATION ON HOW THE PHARMACY CONCEPT WILL AFFECT READINESS AND LOGISTICS PROCESSES EXISTS DURING THE INITIAL FIELDING OF THE HSMS. COLLECTED INFORMATION WILL THEN BE ANALYZED TO DETERMINE THE OPTIMUM SCENARIO FOR FINAL IMPLEMENTATION. TO SUPPORT THIS, WOULD LIKE FORSCOM AND TRADOC TO NOMINATE AN INSTALLATION TO PROTOTYPE FULL IMPLEMENTATION OF THE PHARMACY CONCEPT. EACH WILL NOTIFY THE ACSIM POC IN PARA 6 BELOW NLT 15 MAR 96 OF MILESTONES FOR ESTABLISHING AN INSTALLATION PHARMACY.
5. HSMS REQUIRES THE USE OF INFORMIX, IQ, AND WINDOWS TO SUPPORT IT. INSTALLATIONS WILL NEED TO HAVE EITHER A NETWORK IN PLACE OR USE MODEMS. HARDWARE REQUIREMENTS WILL VARY BY SITE DEPENDING ON AVAILABILITY OF EXISTING EQUIPMENT AND THE NUMBER OF ISSUE/CONTROL POINTS. HSMS DEVELOPERS RECOMMEND A PENTIUM 90 OR 486DX4/100 TERMINAL AND AN HP LASERJET PRINTER WITH 4MB RAM IN ENVIRONMENTAL AND SAFETY OFFICES, A PENTIUM 90 SERVER AND MULTIPLE CD ROM PLAYER IN THE DOIM, AND PENTIUM 90 OR 486DX4/100 TERMINAL AT EACH ISSUE/CONTROL

DA WASH DC
ACTION SASA(1) (A,6,F)
INFO DALO(3) SAM-OPT(1) SCB REVIEW(1) SAAA(1) AOC-AHS(1)
DAIM(2) MPSC(3)

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MCN=96023/31127 TDR=96023/2041Z TAD=96023/2130Z CDSN=MA0324
PAGE 1 OF 2
221200Z JAN 96

OPERATIONS
SUPPORT DIRECTORATE

POINT. EACH ISSUE/CONTROL POINT WILL ALSO REQUIRE AN HP LASERJET PRINTER, BAR-CODE READING EQUIPMENT, BAR CODE PRINTER, AND A LABEL PRINTER.

6. THIS IS A JOINT ACSIM AND DCSLOG MESSAGE. POC FOR PHARMACY IS MR. GEORGE CARLISLE, DAIM-ED-Q, DSN 693-0077. POC FOR LOGISTICS RELATED ISSUES IS MS. REGINA GEORGE, DALO-SMP, DSN 695-2209. BT

APPENDIX D

SITE VISIT SUMMARIES

D-1. INTRODUCTION. The study team visited eight installations which had an active pharmacy operation to increase its level of expertise. The visits included installations from all three Services. This appendix presents a summary of some of the information collected during the site visits. The lessons learned statements were recommendations made by HM pharmacy personnel at the various sites and were current at the time of the visit. These summaries were provided to the installation points of contact for their review. Figure D-1 identifies lessons learned found at all site visits.

<p>PARTICIPANTS</p> <p>Requires active participation from all concerned disciplines MOU must be made between pharmacy manager and units and shops Host/tenant agreements must be established at the installation level</p>	<p>PREIMPLEMENTATION</p> <p>Requires full command support</p> <p>Requires strong marketing strategy to facilitate acceptance Must establish goals and objectives</p>
<p>OPERATIONAL</p> <p>Customer support is paramount Must be implemented incrementally (one unit/shop at a time) Must reevaluate procedures for determining hazardous material basic load and operational load</p>	<p>Consider various pharmacy goals--personnel health and safety, cost savings/avoidance, etc. Can require seed money up front for initial stockage Tracking system must support the business practice</p>

Figure D-1. Lessons Learned from Site Visits

D-2. SITE VISIT - ANDREWS AIR FORCE BASE, MD. Date: 8 February 1996.

a. Installation Background. Established in 1942, Andrews Air Force Base serves as the aerial port of entry for kings, heads of state, and other foreign dignitaries, as well as US government officials. Spanning approximately 4,332 acres, Andrews Air Force Base is also the home of the President's plane - Air Force One; the 1776th Air Base Wing; the 89th Military Airlift Wing; Malcom Grow USAF Medical Center; Headquarters Air Force Systems Command; 10th Aeromedical Staging Flight; 2045th Communication Group; Headquarters Research and Acquisition Communications Division; 1402d Military Airlift Wing (Air Force Reserve); 113th Tactical Fighter Group (Army National Guard); Naval Air Facility; and Marine Aircraft Group 41.

b. Visit Summary

(1) General Information

(a) Staffing. The pharmacy at Andrews Air Force Base was operated under the supply squadron. The pharmacy was staffed during normal duty hours, and personnel were on call 24 hours per day.

(b) Funding. The pharmacy operated from the base stock fund, and local purchases were made by the pharmacy's contracting officer. The contracting officer was the only person authorized to purchase HM with a credit card. All credit card holders were trained, and all credit card statements were reviewed.

(c) Operations. The Bioenvironmental Division (IH) established what materials were tracked, 7-day shop inventory lists, and authorized use lists by reviewing MSDS and historical use data. Units were required to obtain an MSDS prior to ordering materials. In addition to providing the HM supply function, the pharmacy operated a free issue or reuse facility.

(d) Reuse. Units turned in excess materials, which were then offered to other units free of charge.

(e) HW. In addition to managing HM, the pharmacy managed HW. Pharmacy personnel inspected the HW packaging and paperwork and provided the interface with the DRMO and the waste disposal contractors. Funding for waste disposal was an issue. The units were not being charged for waste disposal.

(2) Tracking System. The pharmacy was using the Installation Material Management System (IMMS) for tracking HM. Several problems were noted with the IMMS. The system had a great deal of down time and could only track what was ordered, not what was in stock or what had been used. The pharmacy was expected to convert to the EMIS in the future. Materials were tracked from order to disposal. Functions not tracked by IMMS were tracked by hand on tracking sheets.

(3) Lessons Learned. Andrews personnel suggested that the pharmacy be established under the direct control of the installation commander. It was also noted that a multidisciplinary team should be used to staff the pharmacy. They suggested personnel from contracting, supply, environmental, transportation, Director of Information Management (DOIM), safety, and troop units. It was indicated that it took the team approximately 1 week per squadron to induct units into the pharmacy. This included briefing, conducting an inventory, bar coding items, and processing waste. Pharmacy personnel indicated that having the pharmacy operate using the base stock fund was not an efficient method of funding. The stock fund occasionally would be depleted, leaving the pharmacy unable to make purchases. They suggested a system where the customers "deposit" money into the pharmacy's account throughout the year as a more efficient method of funding. In addition, shelf life management was discussed as an additional problem.

Pharmacy personnel felt that shelf life management should become a Department of Defense priority. Andrews had instituted a policy requiring that all personnel receive HM training as part of their in-processing to a unit.

D-3. SITE VISIT - US AIR FORCE ACADEMY, CO Date: 7 March 1996

a. Installation Background. The US Air Force Academy is essentially a university. Its mission is to train Air Force cadets to become Air Force officers. Industrial type operations are very limited on the Academy.

b. Visit Summary

(1) General Information

(a) Implementation. Operational players included personnel from logistics, safety, environmental, hospital, and operations. Personnel conducted site visits to other installations, which had implemented a pharmacy concept. The pharmacy implementation was 70 percent complete, and it had taken 3 years to reach this point. A 50 percent reduction in inventory had been achieved in areas where the pharmacy had been implemented. Everyone on the Academy will eventually participate in the pharmacy. The pharmacy had the full support of the commanding general.

(b) Staffing. Human resources were taken from existing sources. This required some reorganization. Four additional contractors were hired. The Civil Engineering and Bio-Environmental Division pulled personnel to work in the pharmacy. The Directorate of Logistics had operational control over the pharmacy.

(c) Funding. Pollution prevention funds were used to set up the pharmacy. These funds could not be used for daily operations.

(d) Operation. The pharmacy personnel asked the customers what materials they needed for 1 month of operation, and this was what the pharmacy kept in stock. An attempt was made to order materials in the correct sizes regardless of the cost. No material breakdown was conducted at the pharmacy. Some materials, such as golf course fertilizers and pesticides, were not tracked by the pharmacy. There was a discount for ordering these materials in bulk.

(e) Material Reuse. The pharmacy began accepting items for reuse in December 1994. Only unopened materials were accepted for reuse.

(2) Tracking System. An "off-the-shelf" software package called ENTRACK was being used by the pharmacy. The Air Force had mandated the use of the EMIS for HM tracking. Customers were supposed to return bar code labels to the pharmacy when materials were depleted to complete the tracking loop. If the activities did not do this, they risked exceeding their authorized limit. The pharmacy printed out and distributed bar code lists, which showed what each activity had in stock monthly.

(3) Lessons Learned. Getting control of the HM on the Academy and controlling the routes of entry were the initial goals. Funding expiration caused a stockpiling problem. The activities could only make purchases within a certain period of time. This problem was still being addressed. The pharmacy staff stressed the importance of honoring customers' requests for sole source procurement. Pharmacy personnel needed to remember that each activity was unique, and trust was extremely important to the success of the pharmacy. How HM were defined can have a significant impact on the amount of trust placed in the pharmacy. Training and communication were cited as the biggest problems encountered.

D-4. SITE VISIT - CORPUS CHRISTI ARMY DEPOT (CCAD), TX. Date: 12 March 1996.

a. Installation Background. The CCAD's mission is rotary winged aircraft maintenance and repair. It is primarily a civilian installation with a very industrially based mission. The CCAD is a tenant on a Navy base.

b. Visit Summary

(1) General Information

(a) Implementation. The Depot Maintenance HM Management System (DM-HMMS) (pharmacy concept) was begun in 1993. A copy of a 19 October 1994 Memorandum, Joint Production Instruction (JPI) No. 94-003, DM-HMMS Operating Procedure, established authority, responsibilities, and functions of all CCAD employees in regard to the DM-HMMS. HM issue points were located as close to the shops as possible, and additional issue points were established in areas with high chemical usages. The DM-HMMS personnel had 12 steps to success and credited the CCAD commander with aggressively enforcing the use of the DM-HMMS.

(b) Staffing. Originally the issue points were staffed with temporarily medically disabled personnel. Personnel from the Production Control Directorate took over the operation of the issue points. The Defense Logistics Agency (DLA) had the responsibility for central supply and worked closely with the DM-HMMS personnel.

(c) Funding. The only costs for setting up the DM-HMMS were the computer systems and chain link fencing to secure the issue points. All other materials were surplus. The DM-HMMS appeared to be reducing operational costs at CCAD. In the first 2 years of operation, HM acquisition costs were reduced by \$3.63 million with a net recovery of \$2.98 million. The Safety, Occupational Health, and the Environmental Office approved all credit card purchases for HM. Finance Office would not pay for any unauthorized credit card purchases.

(d) Operation. The Production Control Office ordered all materials for the shops. The DLA received and stored all HM until the issue points requested them. The DLA physically delivered the materials and entered the transaction into the computer tracking system. An attempt was made to order all materials in the correct size. Some materials were bought in bulk and broken down. The shops returned materials to the issue points at the end of the shift. If a

material was not returned to an issue point within 21 days, it was automatically removed from the system. Shops were only authorized to use certain materials. The DM-HMMS staff conducted quarterly complete inventory checks. The manual inventory was compared to the computer inventory.

(e) **Reuse.** All materials were turned in to the issue points at the end of a shift. Pre- and post-use weights were recorded by the issue point operators. Materials were issued until they were depleted.

(2) **Tracking System.** The CCAD was using the DM-HMMS. The Joint Logistics Systems Center provided the operating manuals and helped to set up the system. They also visited the site several times and set up a hot line to assist with questions and problems. This system was developed for use at DOD depots. The DM-HMMS provides MSDS for all the HM at the CCAD; it will also import MSDS from the HM Information System (HMIS). Originally, the system was set up at 10 issue points. The DM-HMMS intentionally did not track HW. There was funding to upgrade the system to a fiber-optic network.

(3) Lessons Learned

(a) **Steps to Success.** The CCAD DM-HMMS staff had 12 steps to success: remove HM from the shop floors and eliminate shop lockers; establish issue control points; establish single base supply; implement a tracking system; dispense in unit of use; reduce inventory; label consolidated inventory; establish local policies; identify and allocate resources; train the "right" people; be diligent about tracking; and improve management/control of HM.

(b) **Training.** HM and DM-HMMS software training was provided to the issue point operators. In the beginning, this caused problems, since the HM issue point operators were not permanently assigned to the DM-HMMS. These problems were corrected when the Directorate of Production Control assumed the responsibility of staffing and operating the HM issue points.

(c) **Operating Hours.** The issue points must be manned whenever the shops are working. One of the issue points was broken into during an overtime shift. Now the issue points operate during all shop working hours.

D-5. SITE VISIT - KELLY AIR FORCE BASE, TX. Date: 14 March 1996

a. **Installation Background.** Kelly Air Force Base operates under the Air Force Materiel Command and is comparable to an Army depot (i.e., more industrial based than a troop installation).

b. Visit Summary

(1) General Information

(a) Implementation. The base began working on HM management in 1982. Implementation had slowed due to the base realignment and closure.

(b) Staffing. Kelly colocated the pharmacy staff in one office. The staff included 4 supply personnel, 3 contracting personnel, and 13 environmental and bioenvironmental (IH) personnel. The colocation was mandated by the Air Force Materiel Command four-star general. In addition to the HM cell, there were 15 forward distribution points. The cell manager had operational management control over all personnel located in the cell. The forward distribution points were manned by organizations affiliated with the shops. Supply operated two depot maintenance forward distribution points.

(c) Funding. The initial funding for the cell came from pollution prevention funding. The Air Force civil engineering headquarters is funding the tracking system implementation at all Air Force bases. All HM were purchased with an up-front stock fund. Occasionally, the stock fund was depleted, and the cell could not purchase materials. Shops paid a prorated portion of the HW disposal costs.

(d) Operations. Supporting the mission of the base was the number one priority. Shops submitted an Air Force Form 3952 for each HM, with a justification statement. Authorizations were determined by reviewing technical orders for each process. Base supply has a system in place to recognize HM purchases and refer them to the cell. The goal was to deliver the materials in the right size for each job. Materials were dropped from the tracking system when they were issued. They were assumed to be used. No credit card purchases of HM were allowed.

(e) Reuse. Unopened materials could be returned to the forward distribution points. Any opened material was considered waste.

(f) HW. The base environmental office was responsible for HW disposal. The EMIS tracked materials until they left the base as a waste.

(2) Tracking System. Kelly was using the EMIS to track HM from requisition until they left the base as a waste. A separate supply system was used. They were currently building an interface between the two systems. A code indicating that materials had left the base had been established for use in deployment situations. The Air Force was implementing EMIS at the rate of a base per week.

(3) Lessons Learned

(a) DLA. The DLA charged \$39.00 per item regardless of size. This discouraged purchasing items in the smallest possible size.

(b) Funding. The cell should have its own money to reduce problems associated with the stock fund being depleted.

(c) Tracking System. The tracking system must support the business practices.

(d) Items Not Tracked. Materials such as herbicides/pesticides, fuel, and auto/craft shop supplies were not purchased through the cell.

D-6. SITE VISIT - FORT EUSTIS, VA. Date: 27 March 1996.

a. Installation Background. Fort Eustis is a TRADOC installation and houses the US Army Transportation Center and the Army Transportation School. The 7th Transportation Group is also stationed at Fort Eustis.

b. Visit Summary

(1) General Information

(a) Implementation. The 7th Group was the only unit/activity implementing the pharmacy concept. The implementation began with one battalion and will eventually be implemented for three out of the four 7th Group battalions. The 11th Battalion was located at Fort Story and would not be included in the initial implementation. Fort Eustis had decided to join the Navy Fleet Industrial Supply Center Regional HM Management System (the Navy's pharmacy system) on a trial basis and planned to involve the entire installation in the future.

(b) Staffing. The Fort Eustis Environmental Office was the initial sponsor of the "HAZMART." The safety, industrial hygiene offices, and the fire company helped by conducting inspections of the activities and the HAZMART. The 7th Group operated the HAZMART with seven military personnel rotating in from the battalion. Recently, an Oakridge Institute for Science and Education (ORISE) research participant was hired to manage the HAZMART as it was expanded to service all battalions of the 7th Transportation Group. This was expected to add continuity to the system.

(c) Funding. Trailers, computers, and a site visit to Point Magu Naval Station were funded out of pollution prevention money. The 7th Group put the stock money up front, and the units were charged as they made requisitions. The 7th Group had a credit card that they would use to make purchases for the HAZMART if it was necessary.

(d) Operations. HAZMART personnel assisted each activity in developing an AUL which became the list of materials that could be purchased by the customer. The AUL is developed by determining demand stock levels for HM and inventorying existing stockages of HM. Each customer was permitted to maintain a 1-2-week supply of HM and their unit deployment load. Accurate demand history for the AUL is vital to providing fast service and correct billing. Other management tasks include preparing requisitions, receiving and issuing materials, and shelf life management.

(e) Reuse. Unopened materials could be returned to the HAZMART for credit. If the HAZMART personnel had questions regarding the quality of the materials, the unit did not receive credit, and the materials were offered as free issue.

(f) **HW.** The HW accumulation area for the Third Port area was contiguously located to the HAZMART. However, a separate staff managed the HW.

(2) **Tracking System.** Fort Eustis was using the Navy's HICS to track the HM in the HAZMART. The Army Construction Engineering Research Laboratory was contracted to assist with the system startup and evaluate the hardware and software requirements.

(3) **Lessons Learned**

(a) **Overall.** The HAZMART proactively manages HM, reduces potential liability, manages shelf life, and prevents stockpiling. In addition, types and quantities of HM procured by an installation are identified, which allows actual HM cost to be assessed.

(b) **Communication/Training.** Aggressive marketing, informational briefings, Officer Professional Development, and other outreach efforts are key to ensuring cooperation from customers. It is important for the installation to develop Standard Operating Procedures/Memorandum of Agreement/Interservice Support Agreement (SOP/MOA/ISA) to document HAZMART staff and customer roles and responsibilities. HAZMART personnel must receive initial and refresher OSHA/DOT training.

(c) **MSDS.** Currently, the HAZMART uses HMIS as a source for MSDS. However, many inaccuracies/omissions exist in these documents. Fort Eustis has initiated the development of an installation-specific MSDS data base. This data base will also reflect HM being reported under the EPCRA. Overseas deployment causes some problems with materials coming back without MSDS and no way of tracking them.

(d) **AUL.** The AUL is the cornerstone for managing, controlling, and documenting the types and quantities of HM used by customers. The AUL should be developed and updated by personnel from the unit/activity, Environmental Division, Safety, and Industrial Hygiene.

D-7. SITE VISIT - FORT CAMPBELL, KY. Date: 23 April 1996.

a. **Installation Background.** Fort Campbell is a FORSCOM installation. The pharmacy concept has been implemented at the 101st Aviation Brigade's aviation maintenance facilities located at Sabre Army Heliport.

b. Visit Summary

(1) General Information

(a) **Implementation.** Sabre Army Heliport was chosen as the initial pharmacy implementation site because it was isolated from the rest of the installation and consists of units with similar missions. The aviation units were brought into the system one at a time.

(b) **Staffing.** DynCorp Aerospace Technology (DynCorp) set up and operated the pharmacy with six employees.

(c) Funding. The Fort Campbell Environmental Office funded the pharmacy implementation and was providing operating funds. The pharmacy ordered materials through the post supply and supply personnel collected funds from the units.

(d) Operations. HM were managed from requisition to disposal. Pharmacy personnel attempted to train all unit personnel in HM management. They also conducted inventories of the shop's locker, established a 7-day supply for each unit, and made up MSDS notebooks for each unit. Pharmacy personnel and unit custodians had keys to the units' lockers and checked the lockers twice per day, restocking them as necessary. In addition, pharmacy personnel maintained the 45-day deployment stock of HM for each customer unit. The deployment stock inventory was determined by unit personnel in conjunction with pharmacy personnel. This management of the deployment stock allowed inventories to be significantly reduced and increased the units' deployment readiness. The pharmacy provided monthly update memorandums to the Sabre Army Heliport commander and was allotted time to discuss their operation in the monthly installation command briefing.

(e) Reuse. The pharmacy was attempting to fill orders with the excess materials obtained from the shop storage lockers. Excess materials were marked with a color-coded dot. Partial containers could be reused if it could be determined that the materials were still in usable condition.

(f) HW. The pharmacy managed HM and HW for the aviation units at Sabre Army Heliport. A satellite storage facility for HW was managed at the pharmacy site. The Department of Public Works Environmental Office picked up HW every 3 days and transported it to the 90-day storage sites. The HW was ultimately disposed of through the DRMO.

(2) Tracking System. During the site visit, the pharmacy was using a standalone Microsoft Access data base to track HM. However, the Hazardous Substance Management System was expected to be implemented in 1996.

(3) Lessons Learned

(a) Credit Card Purchases. The pharmacy personnel felt that some credit card purchases of HM may be slipping through the system. The installation Finance Office was not authorized to approve any credit card HM purchases.

(b) Funding. There was a need for a centralized unit with a funded Department of Defense Automatic Addressal Code (DODDAC) to pull the pharmacy system together for the whole post.

(c) Contingency Pallets. The pharmacy was managing the unit's contingency pallets. This was a hard sell to the unit commanders. The pharmacy must be certified in order to get the pallets on Air Force aircraft.

(d) **Inventory.** The unit's inventory had decreased dramatically, and installation readiness had improved due to better shelf life management and improved inventory control.

D-8. SITE VISIT - FLEET INDUSTRIAL SUPPLY CENTER (FISC) NORFOLK, VA.
Date: 25-27 March 1996

a. Organization Background. FISC Norfolk is the Commander, Naval Supply Systems Command, and Chief of Naval Operations designated Regional HM Manager. The FISC is a centralized HM management cell located on Naval Station Norfolk that works with regional Norfolk Navy and Army commands such as Commander, Naval Air Atlantic Command, Naval Station Norfolk, Naval Amphibious Base, Little Creek, and Fort Eustis via the local command satellite offices. Centralized HM management is practiced, with the goals being to provide the greatest consumption and visibility to all users and achieve financial savings through cost avoidance for disposal and new procurement. The Navy HM pharmacy system is called CHRIMP (Consolidated HM Reutilization and Inventory Management Program). FISC Norfolk is the center for HM operations for most commands in the region.

b. Visit Summary

(1) General Information

(a) Regional Office. The CHRIMP Regional Office is located at the FISC on Naval Station Norfolk. The central regional management cell staff at the FISC is comprised of four to six personnel, both military and civilian. The central warehouse is staffed with three to six civilian and/or military personnel headed by a wage grade supervisor. The regional office and warehouse are staffed during normal duty hours.

(b) Satellite Centers. The Eastern Regional Office has six CHRIMP centers operating under it; these are staffed in the same manner as the regional office on a lower management scale. Personnel at the satellite warehouses are on call 24 hours per day. Some activities provide a soldier/sailor to the local satellite CHRIMP instead of paying the value added surcharge discussed in the next paragraph.

(c) Funding. An ISA is established between the FISC and each satellite center's commanding officer/comptroller to provide the necessary "seed money" up front for initial and periodic shelf stock. A 15 percent value added charge is levied for administrative work such as maintaining inventory and processing requisitions; however, free issue materials are currently not charged, but this may change in the future. Monthly statements are issued to each activity showing what was purchased, what was free, and value added charges paid.

(d) Operations. A memorandum of understanding (MOU) is established between the FISC and each satellite center's commanding officer. The central warehouse uses "just in time" (JIT) delivery within 1 day of ordering. The regional CHRIMP office has an 800 number for assistance. The Defense Logistics Agency supplies the FISC and satellite centers with funding as discussed previously. The central CHRIMP center has 2 months of supplies at one site. The six CHRIMP satellite centers have 2 weeks of inventory at each site. Currently, one

driver from the Center site supports the satellites, but this is scheduled to increase to two. Each satellite HM pharmacy operates from the base stock, and local purchases are made by the pharmacy's contracting officer. The ships at the Naval Station piers have their own CHRIMPs.

(e) Reuse. Units turn in excess materials, which are then offered to other units free of charge. The FISC regional office operates the Regional HM Management System (RHMMS). This system allows non-CHRIMP Center customers to use the free issue inventory. If the customer does not want reissued materials, the order is automatically dumped to the supply system. As the amount of excess materials is eliminated, the system's inventory is expected to decrease dramatically. At this time, a savings of \$3,000 per quarter has been realized. Decommissioning ships generates much of the excess, and ships in general may access the regional CHRIMP office for HM.

(f) HW. The Directorate of Public Works (DPW) is currently responsible for disposal of HW at Norfolk for the FISC. This varies from base to base. The DPW levies a surcharge on all HW. It is possible that HW will eventually be managed through the FISC regional offices, eliminating the HW surcharge.

(2) Tracking System. The Navy is currently using both the Navy HM HICS and the DOD HSMS software. The Norfolk regional office runs the DM-HMMS, HICS, and HSMS as well as RHMMS. Eventually, the systems are planned to interface with each other, or one system will be adopted.

(3) Lessons Learned

(a) Operations. Cooperation and communication between FISC and all of the Navy installation hazardous waste minimization (HAZMIN) center employees appears to be the key in this system as was the case with the other Air Force and Army installations. Interfacing with the DLA logistics system via RHMMS was critical to provide customers with latest information on available HM.

(b) Development. It seems as though the HM management was brought to the shops from the "bottom up." This may have helped to make the system more acceptable. There is no one way to establish HM centralized control.

(c) Marketing. The FISC initially fostered program advocacy with cost savings. Cost avoidance is now the term used. The concept seems to be well received by the Navy chain of command regardless of the "selling point." Because there is no one way to establish HM centralized control, defining cost avoidance and other business metrics has not been done to date.

(d) Mandate. The Office of the Chief of Naval Operations mandate was critical to the program's success thus far.

D-9. SITE VISIT - FLEET AND INDUSTRIAL SUPPLY CENTER (FISC) SAN DIEGO.

Date: 1-3 April 1996.

a. Organization Background. FISC San Diego is the Commander, Naval Supply Systems Command and Chief of Naval Operations designated Regional HM Manager. The FISC operates a centralized HM management cell located on Naval Station San Diego that works with regional San Diego Navy and Marine Corps commands such as Commander, Naval Surface Force US Pacific Fleet, Commander, Naval Air Force US Pacific Command, Naval Station, San Diego, Public Works Center (PWC), San Diego, Naval Amphibious Base, Coronado, Naval Air Station (soon to be Marine Corps Air Station (MCAS)), Miramar, Naval Submarine Base, San Diego and Naval Air Station North Island via the local command satellite offices. Centralized HM management is practiced with the goals being to provide the greatest consumption and visibility to all users and achieve financial savings through cost avoidance for disposal and new procurement. The Navy HM pharmacy System is referred to as the Consolidated HM Reutilization and Inventory Management Program (CHRIMP). FISC San Diego is the center for HM operations for almost all commands in the region. HM management in San Diego began in 1992 with an independent effort from the Naval Station taking in excess/expired HM from ships. In 1993, FISC was brought in to run the program.

b. Visit Summary

(1) General Information

(a) Regional Office. The CHRIMP Regional Office is located at the FISC on Naval Station, San Diego. The central regional management cell staff at the FISC is comprised of five to seven civilian personnel. A GS-12/13 heads the central staff. The central HM warehouse is staffed with 8 to 10 civilian and/or military personnel headed by a wage grade supervisor. The regional office and warehouse are staffed during normal duty hours.

(b) Satellite Centers. The Southern California Region has 11 CHRIMP centers operating under it which are staffed in the same manner as the regional office on a lower personnel management scale. Military duty personnel are available for after hours issues. Some activities provide a soldier/sailor to the local satellite HAZMIN center (HAZMINCEN) instead of paying the labor charges for a civilian discussed in next paragraph.

(c) Funding. An ISA is established between the FISC and each satellite center's commanding officer and comptroller to provide the necessary "seed money" up front for initial and periodic shelf stock. At the present time, in contrast to the Norfolk effort, customers are not being surcharged for HM services. Monthly statements are issued to each activity showing what was purchased, what was free, and labor/nonlabor charges.

(d) Operations. An MOU is established between the FISC and each satellite center's commanding officer. The central warehouse uses JIT delivery within 1 day of ordering. The DLA supplies the FISC and satellite centers with material. The central CHRIMP center has 2 months of supplies at one site. The seven FISC operated HAZMIN centers (PWC shares

Naval Station's) have 2 weeks of inventory at each site. Currently, two state-certified drivers support distribution to the satellites. Each satellite HM pharmacy operates from the base stock and local purchases are made by the regional staff's contracting officer. The ships have their own CHRIMPs.

(e) Reuse. Units turn in excess materials, which are then offered to other units free of charge. The San Diego FISC regional office centrally manages HM and HM reuse materials off an FISC-developed data base. As the amount of excess materials is eliminated, the system's inventory is expected to decrease dramatically. Decommissioning ships generates much of the excess and ships in general may access the regional CHRIMP office for HM.

(f) HW. The San Diego Public Works Center (PWC) is currently responsible for disposal of most HW at San Diego. At some sites HW is turned in directly to DRMO for ultimate disposal via contractor. This varies from base to base. The PWC levies a surcharge on all HW. It is possible that HW will eventually be managed through the same FISC regional offices.

(2) Tracking System. The Navy is currently using both the Navy HICS and the DOD HSMS software. The San Diego regional office runs HICS and a central data base which is tied to the other shore installation's (ships are independent) HM pharmacy operations by modem. Eventually, both software systems are planned to interface with each other or one system will be adopted.

(3) Lessons Learned

(a) Operations. Cooperation and communication between FISC and all of the Navy installation HAZMINCEN employees appear to be the key in this system as was the case with the other Air Force and Army installations. Specific examples include:

- Establish single base supply "choke" point.
- Implement an HM tracking system.
- Dispense/order in the units of use. Do not recontainerize materials.
- Reduce HM inventory and expired items.
- Label consolidated inventory.

Current programs operating in conjunction with the satellite HM pharmacies or "HAZMARTs."

- Shop Towel Service
- Remanufactured Laser Cartridges and Ribbons
- Electronic Bulletin Board System
- Lube Oil and Aqueous Fire Fighting Foam Reuse
- Shelf Life Training

(b) Development. It seems as though the HM management was brought to the shops from the "bottom up." This may have helped to make the system more acceptable. There is no one way to establish HM centralized control. The issue points were located as convenient to all the shops as possible.

(c) Marketing. The FISC initially fostered program advocacy with cost savings. Cost avoidance is now the term used. The concept seems to be well received by the Navy chain of command regardless of the "selling point."

(d) Mandate. The Office of the Chief of Naval Operations mandate was critical to the program's success thus far.

APPENDIX E

DESCRIPTION OF TURBOBPR MODEL

E-1. INTRODUCTION. This appendix presents a technical summary of the key algorithms used in the TurboBPR Corporate Information Management (CIM) support tool. The TurboBPR software was recommended by representatives of the US Army Cost and Economic Analysis Center (CEAC). The equations presented in this appendix were obtained from the TurboBPR help files.

E-2. BACKGROUND. The ALCHMMI study team made use of a portion of the capabilities of the business process reengineering software package, TurboBPR, to assist with the economic analysis. TurboBPR is a part of a continuing effort to improve the business process reengineering methodology and its applications within DOD. It incorporates many of the concepts and analysis techniques first described in the Functional Economic Analysis (FEA) Guidebook. The purpose of the FEA Guidebook was to show functional managers how to perform functional economic analysis consistent with the official guidance, found in DOD 8020.1-M, Functional Process Improvement. A copy of the most recent version of the FEA Guidebook can be obtained by contacting CIM Support Services at 1-800-TELL-CIM.

E-3. MATHEMATICAL DESCRIPTION OF MODEL ALGORITHMS

a. Calculating Alternative Investment Costs and Impacts. TurboBPR computes alternative costs and impacts from the initiative costs and impacts that the user enters.

(1) High, Low, and Expected Investment Costs. The expected investment cost of an alternative is the sum of the investment costs of all initiatives included in the alternative. For a given alternative, the expected investment cost in year t is:

$$EC(t) = \sum_{k \in A} C(t, k)$$

where $C(t, k)$ is the expected investment cost for initiative k in year t . The term $k \in A$ means include only the initiatives that are in the given alternative. The user also inputs high and low percentages for each initiative. The user should choose the low percentage to reflect the value beyond which costs could not realistically fall. Similarly, the high percentage reflects the value above which costs could not realistically rise. TurboBPR uses the high and low percentages to bound the total investment cost for each alternative. The high investment cost for a given alternative in year t is:

$$HC(t) = \sum_{k \in A} (1 + \eta_k) \times C(t, k)$$

where η_k is the high cost percentage for initiative k . The total low investment cost is:

$$LC(t) = \sum_{k \in A} (\lambda_k) \times C(t, k)$$

where λ_k is the low cost percentage for initiative k.

(2) High, Low, and Expected Cost Impacts. TurboBPR computes the cost impacts for each alternative in a similar manner. For a given alternative, the total expected cost impact in year t is:

$$EB(t) = \sum_{k \in A} B(t, k)$$

where $B(t, k)$ is the impact of initiative k in year t. The high impact in year t is:

$$HB(t) = \sum_{k \in A} (1 + \delta_k) \times B(t, k)$$

where δ_k is the high impact percentage for initiative k. The low impact in year t is:

$$LB(t) = \sum_{k \in A} (\varepsilon_k) \times B(t, k)$$

where ε_k is the low impact percentage for initiative k.

(3) High, Low, and Expected Total Cost. The total cost of an alternative is the sum of its investment costs and its impacts. Therefore, the expected cost for an alternative is:

$$E_{TC}(t) = EC(t) + EB(t)$$

To compute total high cost, first consider the cost impacts. Since negative impacts represent cost savings, the more negative the impact, the lower total operations costs will be. Conversely, the more positive the impact, the higher total operations costs will be. Total cost will be at its highest when the investment cost is at its highest and the cost impact is at its lowest. The total estimated high cost in year t for a given alternative is :

$$H_{TC}(t) = HC(t) + LB(t)$$

which is the sum of its high investment cost and its low cost impact. Similarly, the total estimated low cost in year t for a given alternative is:

$$L_{TC}(t) = LC(t) + HB(t)$$

(4) The Triangular Distribution. Since cost is really a continuous variable, its representation by only the high, expected, and low outcomes is an approximation. However, these specific outcomes can be used to estimate a continuous cost distribution. TurboBPR uses a triangular distribution to estimate the mean and the variance of the alternative costs. The

triangular distribution was used for two reasons. First, the only required parameters are the mode and the endpoints (high and low values). Once these three parameters are specified, the mean and variance are predetermined. Second, users can express most likely (i.e., mode) and endpoint estimates more easily than the mean, variance, and bounds required by more complicated distributions. Given the mode, high, and low values, the mean of the triangular distribution is:

$$\mu = \frac{Low + Mode + High}{3}$$

The variance of the triangular distribution is:

$$\sigma^2 = \frac{(High - Low)^2 + (Mode - High)(Mode - Low)}{18}$$

TurboBPR estimates the mean and variance of the cost for a given alternative in year t as:

$$\mu_{TC}(t) = \frac{L_{TC}(t, A) + E_{TC}(t, A) + H_{TC}(t, A)}{3}$$

and

$$\sigma_{TC}^2(t, A) = \frac{(H_{TC}(t) - L_{TC}(t))^2 + (E_{TC}(t) - H_{TC}(t))(E_{TC}(t) - L_{TC}(t))}{18}$$

where mode = $E_{TC}(t)$, low = $L_{TC}(t)$, and high = $H_{TC}(t)$.

b. Discounting Alternative Costs. TurboBPR employs the “end-of-year” discounting convention to discount all costs to their present values. This means that even costs in the first year of analysis will be discounted. The net discounted expected cost for a given alternative over the period of analysis is:

$$E = \sum_{t=1}^n \frac{E_{TC}(t)}{(1+r)^t}$$

where n is the number of years in the analysis and r is the discount rate. The net discounted high and low costs for an alternative are likewise computed as:

$$H = \sum_{t=1}^n \frac{H_{TC}(t)}{(1+r)^t}$$

and

$$L = \sum_{t=1}^n \frac{L_{TC}(t)}{(1+r)^t}$$

respectively. The mean cash flow is:

$$\mu = \sum_{t=1}^n \frac{\mu_{TC}(t)}{(1+r)^t}$$

and the variance is:

$$\sigma^2 = \sum_{t=1}^n \frac{\sigma_{TC}^2(t)}{(1+r)^{2t}}$$

c. Discounted Payback. The discounted payback of an alternative is found by counting the number of years it takes before the total discounted cost impacts equal the total discounted investment. That is, find m such that:

$$\sum_{t=1}^m \frac{impacts(t)}{(1+r)^t} = \sum_{t=1}^m \frac{investment(t)}{(1+r)^t} \quad 1 \leq m \leq n$$

where n is the number of years in the investment life cycle; r is the discount rate; $impacts(t)$ = the alternative cost impact in year t ; $investment(t)$ = the alternative investment cost in year t .

d. Adjusting for Risk. TurboBPR assumes that the risk-adjusted discounted costs have a Beta distribution. The Beta distribution was chosen for its flexibility, not because of any a priori knowledge that it is the actual cost distribution. TurboBPR estimates the mean and variance of the Beta distribution using the previously calculated mean and variance discounted cash flow values. The Beta distribution has two shape parameters, α and β . Using the mean, variance, high, and low discounted values, TurboBPR computes α and β as follows:

$$\alpha = \frac{(\mu - L)^2 \times (H - \mu)}{\sigma^2 \times (H - L)} - \frac{\mu - L}{H - L}$$

and

$$\beta = \frac{\alpha \times (H - \mu)}{\mu - L}$$

TurboBPR reports most likely risk adjusted cost as:

$$M_R = L + (H - L) \times \frac{1 - \alpha}{2 - \alpha - \beta}$$

which is the mode of the Beta distribution. TurboBPR uses the 2.5 and 97.5 percentiles from the risk-adjusted discounted cash flow risk-adjusted discounted cash flow (RADCF) distribution to estimate the low and high costs respectively. The 97.5 percentile is the value π_H that lies above 97.5 percent of the costs predicted by the risk-adjusted cost distribution. The high risk-adjusted discounted cost estimate is:

$$H_R = L + (H - L) \times \pi_H$$

where:

$$\frac{\Gamma(\alpha + \beta)}{\Gamma(\alpha)\Gamma(\beta)} \int_0^{\pi_H} x^{\alpha-1} (1-x)^{\beta-1} = 0.975$$

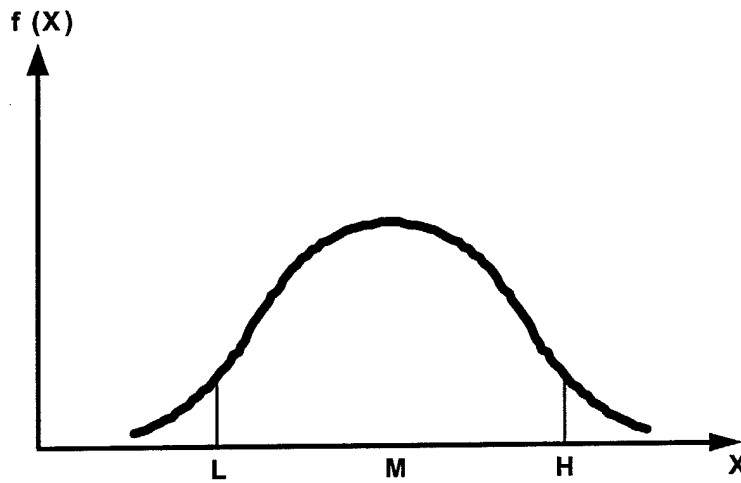
The 2.5 percentile is the value π_L that is greater than only 2.5 percent, or lower than 97.5 percent, of the costs predicted by the risk-adjusted cost distribution. The low risk-adjusted discounted cost estimate is:

$$L_R = L + (H - L) \times \pi_L$$

where

$$\frac{\Gamma(\alpha + \beta)}{\Gamma(\alpha)\Gamma(\beta)} \int_0^{\pi_L} x^{\alpha-1} (1-x)^{\beta-1} = 0.025$$

The high, expected, and low risk-adjusted discounted cost values are depicted in the graph below.



e. Net Present Value

The net present value (NPV) of an alternative is defined as:

$$\sum_{t=1}^n \frac{\text{investment}(t) + \text{impacts}(t)}{(1+r)^t}$$

where n is the number of years in the investment life cycle
and r is the discount rate

impacts (t) = the alternative cost impact in year t

investment (t) = the alternative investment cost in year

APPENDIX F

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APPENDIX G

IMPACT ON LOGISTIC INITIATIVES

G-1. INTRODUCTION. A review of selected ongoing logistics initiatives was conducted to determine potential (positive and negative) impacts from the HM pharmacy initiative implementations. In order to assess impacts, it was necessary to develop an overview of the logistic initiatives. The ALCHMMI study team focused its efforts on three key logistic initiatives: Army total asset visibility, velocity management, and total Army inventory management. The following is a brief summary of the logistic initiatives and an assessment of potential impacts from HM pharmacy initiatives.

G-2. ARMY TOTAL ASSET VISIBILITY (ATAV)

a. Summary. ATAV is one of several initiatives created in response to the Defense Management Review Study of 1988. The effort is being worked by LIA and the Major Item Information Center of the Logistics Support Activity. ATAV is an assimilator of data that provides capability to assimilate data from as many as 42 data sources. It becomes a single source of asset information for use by managers at all levels throughout the Army. ATAV uses data from existing sources and creates no additional reporting requirements. The initiative was developed utilizing innovative total quality management (TQM) related principles of rapid prototype development to maximize quick results at lowest cost. ATAV provides its users asset information, including onhand, due-in/out, and owner. A wealth of other information is available, including weapon system data and contract information, online cataloging data, force structure data, and visibility of Army war reserve and operational project stocks. ATAV is intended to become an interactive network of computers, gateways, and data bases utilizing a reach-through approach to assimilate data and provide a centralized comprehensive data base.

b. Impact. Implementation of the HM pharmacy concept itself would have little impact on ATAV. Implementation of an HM pharmacy automated system may provide an additional data source that should offer accurate and timely HM related data. The HM pharmacy automated system would take visibility down to the individual shop bench stock level. This would enhance asset visibility gained through ATAV which is only intended to go down to the overall shop stock level.

G-3. VELOCITY MANAGEMENT (VM)

a. Summary. VM is an initiative by senior logisticians designed to improve logistics processes to make them more effective and efficient in sustaining mission accomplishment. It advocates substituting velocity and accuracy for massive inventories. The effort is chaired by a triad consisting of the Deputy Chief of Staff for Logistics (DCSLOG), AMC Deputy Commanding General (DCG), and the Combined Areas Support Command Commanding General (CASCOC). In addition to making the logistics community aware of the initiative, initial VM efforts focused on improving performance of the order, ship, repair, and stockage determination processes. Stockage determination was defined as "stocking the right parts in the

right place to ensure uninterrupted logistics support.” A main objective during the past year was a reduction in the order to ship time. For purposes of the VM initiative, OST was defined as “the time elapsed from requisition of an item (by the user) to the receipt of the item by the user.” Although the initial focus of VM is on Class IX, spare parts, the concept can be applied to all classes of supply. VM implementation involves three steps as follows: Step 1, define the process; Step 2, measure process performance; Step 3, improve the process. Successful implementation and use of the VM approach to refine logistics processes will result in cost savings through reduced inventories, and reduced labor costs associated with managing and handling inventories.

b. Impact. An HM pharmacy appears to have minimal adverse impact on VM and does seem to complement many of the VM goals and objectives. The HM pharmacy should facilitate VM OST reduction goals where the VM OST definition is used. The HM pharmacy is in concert with the VM philosophy to substitute accuracy for massive inventories and should improve the HM stockage determination process. As with VM, successful implementation of the pharmacy concept should result in cost savings through reduced inventories and reduced labor costs associated with managing and handling those reduced inventories. An HM pharmacy has the potential to reduce the overall usage and stockpile level of HM stocks, and it uses precision and pinpoint distribution to do that. It has the potential to significantly reduce the amount of time it takes to get material into the hands of the user and has enough flexibility to minimize, if not eliminate, the concern of some within the logistics community of creating “choke points” in the process. As defined, OST should be reduced to the hours it takes to process the requisition at the centralized management location rather than the days it would take to get material through the supply system. It would still take the same amount of time to backfill material through the supply system once it was requisitioned by the centralized management cell.

G-4. TOTAL ARMY INVENTORY MANAGEMENT (TAIM)

a. Summary. TAIM is a management concept that provides the Army philosophy for overall stewardship of the Army inventory. It covers most classes of supply and is intended to assist the Army in meeting Defense Management Review decisions that require an overall reduction in inventory levels. It includes a review of the total stockpile and an assessment of requirements to determine if material is excess one place but in demand someplace else.

b. Impact. No adverse impact anticipated. The HM pharmacy should facilitate the TAIM efforts. It should provide an opportunity to collect data from a source that consolidates HM asset data in a timely and accurate manner. It should help determine if material is excess one place but in demand someplace else. An HM pharmacy is also intended to reduce overall HM inventory and usage level.

G-5. SUMMARY. This appendix provides a cursory review of selected logistics initiatives to determine potential adverse impacts that may result from implementation of the HM pharmacy concept. This review indicates that the HM pharmacy tends to complement rather than negatively impact the logistics initiatives. A more thorough review by those proficient with each logistic initiative may be required during any implementation efforts to assure that potential adverse impacts are minimized.

APPENDIX H

COST AND BENEFIT ANALYSIS CALCULATIONS

H-1. INTRODUCTION. This appendix describes the components and operating characteristics of the cost and benefit analysis model inputs. It is intended to provide an overview of portions of the model's structure. It is not intended to serve as an instructional document covering all aspects of model construction and operation.

a. Spreadsheet. A spreadsheet was developed to relate the HW generation amounts to the HM initiative costs and impacts. This paragraph describes the general equations and assumptions for the spreadsheet cells in Figure H-1. The rows imported into TurboBPR for conduct of the economic analysis are identified.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	INPUTS								Baseline Costs							
2	HW amount (900 lbs)	528.4	Used to calculate disposal and procurement costs						Disposal	\$ 1,056	Based on 100% of waste being disposed at \$2.00 / lb					
3	40% of HW	211.2	Amount of waste that is reusable						Procurement	\$ 704	Based on 40% of material not required to be purchased again					
4	Disposal avoidance	\$ 422.40	Based on \$2.00 / lb disposal cost								211.2	How much material is not needed to store or handle				
5	Total Avoidance	\$ 704.00	Based on 80% of savings coming from disposal avoidance													
6	Procurement avoid	\$ 281.60	Based on 40% of savings coming from procurement avoidance													
7	Validation	\$ 704.00														
8																
9																
10																
11	ITEM COSTS															
12																
13	ADP R.S	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
14	Software R.S	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
15	Supplies R	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
16	Initial Inventory (I)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
17	Training R	\$ 40	\$ 40	\$ 40	\$ 40	\$ 40	\$ 40	\$ 40	\$ 40	\$ 40	\$ 40	\$ 40	\$ 40	\$ 40	\$ 40	\$ 40
18	Facilities (I)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
19	Public relations (R)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
20	Transportation (I)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
21	Staffing (R)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
22	Disposal (R)	\$ 1,056	\$ 1,056	\$ 1,056	\$ 1,056	\$ 1,056	\$ 1,056	\$ 1,056	\$ 1,056	\$ 1,056	\$ 1,056	\$ 1,056	\$ 1,056	\$ 1,056	\$ 1,056	\$ 1,056
23	Procurement (R)	\$ 704	\$ 704	\$ 704	\$ 704	\$ 704	\$ 704	\$ 704	\$ 704	\$ 704	\$ 704	\$ 704	\$ 704	\$ 704	\$ 704	\$ 704
24	Inventory costs R	\$ 141	\$ 141	\$ 141	\$ 141	\$ 141	\$ 141	\$ 141	\$ 141	\$ 141	\$ 141	\$ 141	\$ 141	\$ 141	\$ 141	\$ 141
25	EPCRA Report contracting R	\$ 80	\$ 80	\$ 80	\$ 80	\$ 80	\$ 80	\$ 80	\$ 80	\$ 80	\$ 80	\$ 80	\$ 80	\$ 80	\$ 80	\$ 80
26																
27		\$ 2,001	\$ 2,001	\$ 2,001	\$ 2,001	\$ 2,001	\$ 2,001	\$ 2,001	\$ 2,001	\$ 2,001	\$ 2,001	\$ 2,001	\$ 2,001	\$ 2,001	\$ 2,001	\$ 2,001
28																
29	Pharmacy costs															
30	ADP R.S	\$ 10.00														
31	Software R.S	\$ 0.45														
32	Supplies R	\$ 2.00														
33	Initial Inventory (I)	\$ 4.00														
34	Training R	\$ 40.00														
35	Facilities (I)	\$ 15.00														
36	Public relations (R)	\$ 2.00														
37	Transportation (I)	\$ 10.00														
38	Staffing (R)	\$ 25.00														
39	Disposal (R)	\$ 1,056.00														
40	Procurement (R)	\$ 704.00														
41	Inventory costs R	\$ 141.00														
42	EPCRA Report contracting R	\$ 80.00														
43																
44																
45	Initiative costs (Initiative 1) Establish reuse procedures															
46	ITEM															
47	ADP R.S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	Software R.S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	Supplies R	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	Initial Inventory (I)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	Training R	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	Facilities (I)	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	Public relations (R)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
54	Transportation (I)	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	Staffing (R)	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
56																
57		45.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9
58	Cost impacts (Initiative 1) Establish reuse procedures															
59	Disposal	0	-126.72	-126.72	-126.72	-114.048	-102.643	-92.3769	-83.140992	-74.8269	-67.3442	-60.6098	-54.5488			
60	Procurement	0.0	-56.32	-56.32	-56.32	-50.688	-45.6192	-41.0573	-36.951552	-33.2564	-29.6308	-26.9377	-24.2439			
61	Inventory costs	0.0	-9.40544	-9.40544	-9.40544	-8.464896	-7.61841	-6.85857	-6.17090816	-5.55282	-4.99844	-4.49859	-4.04873			
62	EPCRA Report contracting															
63																
64		0.0	-192.4	-192.4	-192.4	-173.2	-155.9	-140.3	-126.3	-113.6	-102.3	-92.0	-82.8			
65	Performance impacts (Initiative 1) Establish reuse procedures															
66	HW generation		-83.4	-83.4	-83.4	-57.0	-51.3	-46.2	-41.6	-37.4	-33.7	-30.3	-27.3			

Figure H-1. Cost and Benefit Analysis Spreadsheet
(page 1 of 4 pages)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
67	Inventory level		-4.7	-4.7	-4.7	-4.2	-3.8	-3.4	-3.1	-2.8	-2.5	-2.2	-2.0			
68	Order to ship time		0.0	0.0	0.0											
69	ISR Part I		0.0	0.0	0.0											
70	ISR Part II		4.8	4.8	4.8											
71																
72		Initiative costs (Initiative 2) Order / disburse by unit of use vs unit of issue														
73	ITEM	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008			
74	ADP R.5															
75	Software R.5															
76	Supplies R	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4			
77	Initial Inventory (I)															
78	Training R															
79	Facilities (I)															
80	Public relations (R)															
81	Transportation (I)	10	0	0	0	0	0	0	0	0	0	0	0			
82	Staffing (R)	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5			
83																
84		22.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9			
85		Cost impacts (Initiative 2) Order / disburse by unit of use vs unit of issue														
86																
87	Disposal	0	-63.36	-63.36	-63.36	-57.024	-51.3216	-46.1894	-41.570496	-37.4134	-33.8721	-30.3049	-27.2744			
88	Procurement	0	0	0	0	0	0	0	0	0	0	0	0			
89	Inventory costs	0	-9.40544	-9.40544	-9.40544	-8.484896	-7.61841	-6.85657	-6.17090918	-5.55382	-4.99844	-4.49859	-4.04873			
90	EPCRA Report contracting	0														
91																
92		0	-72.76844	-72.76844	-72.76844	-65.4889	-58.94	-53.046	-47.7414052	-42.9673	-38.6705	-34.8035	-31.3231			
93																
94		Performance impacts (Initiative 2) Order / disburse by unit of use vs unit of issue														
95	HW generation		-31.7	-31.7	-31.7	-28.5	-25.7	-23.1	-20.8	-18.7	-16.8	-15.2	-13.6			
96	Inventory level		-4.7	-4.7	-4.7	-4.2	-3.8	-3.4	-3.1	-2.8	-2.5	-2.2	-2.0			
97	Order to ship time		0	0	0											
98	ISR Part I		0	0	0											
99	ISR Part II		2.4	2.4	2.4											
100																
101		Initiative costs (Initiative 3) Establish centralized issue / storage points														
102	ITEM	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008			
103	ADP R.5	1.5					1.5									
104	Software R.5	0.0675					0.0675									
105	Supplies R	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4			
106	Initial Inventory (I)															
107	Training R															
108	Facilities (I)	82														
109	Public relations (R)															
110	Transportation (I)	30														
111	Staffing (R)	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5			
112																
113		211.4075	87.9	87.9	87.9	87.9	89.4075	87.9	87.9	87.9	87.9	87.9	87.9			
114		Cost impacts (Initiative 3) Establish centralized issue / storage points														
115	Disposal															
116	Procurement															
117	Inventory costs															
118	EPCRA Report contracting															
119		0	0	0	0	0	0	0	0	0	0	0	0			
120		Performance impacts (Initiative 3) Establish centralized issue / storage points														
121	HW generation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
122	Inventory level	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
123	Order to ship time		-14.5	-14.5	-14.5											
124	ISR Part I		0	0	0											
125	ISR Part II		24	24	24											
126																
127		Initiative costs (Initiative 4) Establish centralized HM management cell														
128	ITEM	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008			
129	ADP R.5	1.5					1.5									
130	Software R.5	0.0675					0.0675									
131	Supplies R	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4			
132	Initial Inventory (I)															

Figure H-1. Cost and Benefit Analysis Spreadsheet
(page 2 of 4 pages)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
133	Training R	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
134	Facilities (I)															
135	Public relations (R)	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
136	Transportation (I)															
137	Staffing (R)	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
138																
139		95.0675	93.5	93.5	93.5	93.5	95.0675	93.5	93.5	93.5	93.5	93.5	93.5	93.5	93.5	93.5
140	Cost impacts (Initiative 4) Establish centralized HM management cell															
141	Disposal	0	-63.38	-63.38	-63.38	-57.024	-51.3216	-46.1894	-41.570496	-37.4134	-33.6721	-30.3049	-27.2744			
142	Procurement	0.0	-56.32	-56.32	-56.32	-50.688	-45.6192	-41.0573	-36.951552	-33.2564	-29.9308	-26.9377	-24.2439			
143	Inventory costs	0.0	-9.40544	-9.40544	-9.40544	-8.464896	-7.61841	-6.85057	-6.17090918	-5.55382	-4.99844	-4.49859	-4.04873			
144	EPCRA Report contracting	0.0	-19.98	-19.98	-19.98	-17.982	-16.1838	-14.5854	-13.108878	-11.798	-10.6182	-9.55637	-8.60073			
145																
146		0.0	-149.1	-149.1	-149.1	-134.2	-120.7	-108.7	-97.8	-88.0	-79.2	-71.3	-64.2			
147	Performance impacts (Initiative 4) Establish centralized HM management cell															
148	HW generation		-31.7	-31.7	-31.7	-28.5	-25.7	-23.1	-20.8	-18.7	-16.8	-15.2	-13.8			
149	Inventory level		-4.7	-4.7	-4.7	-4.2	-3.8	-3.4	-3.1	-2.8	-2.5	-2.2	-2.0			
150	Order to ship time		0.0	0.0	0.0											
151	ISR Part I		0.0	0.0	0.0											
152	ISR Part II		45.0	45.0	45.0											
153																
154	Initiative costs (Initiative 5) Establish authorized user / use list															
155	ITEM	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008			
156	ADP R.5															
157	Software R.5															
158	Supplies R															
159	Initial inventory (I)															
160	Training R															
161	Facilities (I)															
162	Public relations (R)															
163	Transportation (I)															
164	Staffing (R)	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
165																
166	Cost impacts (Initiative 5) Establish authorized user / use list															
167		12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
168	Disposal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
169	Procurement	0.0	-26.16	-26.16	-26.16	-25.344	-22.8096	-20.5286	-18.475776	-16.6282	-14.9654	-13.4688	-12.122			
170	Inventory costs	0.0	-9.40544	-9.40544	-9.40544	-8.464896	-7.61841	-6.85057	-6.17090918	-5.55382	-4.99844	-4.49859	-4.04873			
171	EPCRA Report contracting															
172		0.0	-37.6	-37.6	-37.6	-33.8	-30.4	-27.4	-24.6	-22.2	-20.0	-18.0	-16.2			
173	Performance impacts (Initiative 5) Establish authorized user / use list															
174		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
175	HW generation		-4.7	-4.7	-4.7	-4.2	-3.8	-3.4	-3.1	-2.8	-2.5	-2.2	-2.0			
176	Inventory level		0.00	0.00	0.00											
177	Order to ship time		0.00	0.00	0.00											
178	ISR Part I		0.00	0.00	0.00											
179	ISR Part II		16.80	16.80	16.80											
180																
181	Initiative costs (Initiative 6) Implement a tracking system															
182	ITEM	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008			
183	ADP R.5	7					7									
184	Software R.5	0.315					0.315									
185	Supplies R	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
186	Initial inventory (I)															
187	Training R															
188	Facilities (I)															
189	Public relations (R)															
190	Transportation (I)															
191	Staffing (R)	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
192																
193		20.215	12.9	12.9	12.9	12.9	20.215	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9
194	Cost impacts (Initiative 6) Implement a tracking system															
195	Disposal	0	-63.38	-63.38	-63.38	-57.024	-51.3216	-46.1894	-41.570496	-37.4134	-33.6721	-30.3049	-27.2744			
196	Procurement	0.0	-56.32	-56.32	-56.32	-50.688	-45.6192	-41.0573	-36.951552	-33.2564	-29.9308	-26.9377	-24.2439			
197	Inventory costs															
198	EPCRA Report contracting	0.0	-40.02	-40.02	-40.02	-36.018	-32.4162	-29.1746	-26.257122	-23.6314	-21.2663	-19.1414	-17.2273			

Figure H-1. Cost and Benefit Analysis Spreadsheet
(page 3 of 4 pages)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
199																
200		0.0	-159.7	-159.7	-159.7	-143.7	-129.4	-118.4	-104.8	-94.3	-84.9	-76.4	-68.7			
201		Performance Impacts (Initiative 6) Implement a tracking system														
202			-31.7	-31.7	-31.7	-28.5	-25.7	-23.1	-20.8	-18.7	-16.8	-15.2	-13.8			
203	HW generation		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
204	Inventory level		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
205	Order to ship time		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
206	ISR Part I		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
207	ISR Part II		22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0			
208		Initiative costs (Initiative 7) Establish inventory levels at user / operator level														
209	ITEM	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008			
210	ADP R.5															
211	Software R.5															
212	Supplies R															
213	Initial Inventory (I)															
214	Training R															
215	Facilities (I)															
216	Public relations (R)															
217	Transportation (I)															
218	Staffing (R)	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5			
219		12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5			
220		12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5			
221		Costs Impacts (Initiative 7) Establish inventory levels at user / operator level														
222	Disposal	0	-63.36	-63.36	-63.36	-57.024	-51.3218	-46.1894	-41.570498	-37.4134	-33.6721	-30.3049	-27.2744			
223	Procurement	0.0	-56.32	-56.32	-56.32	-50.688	-45.6192	-41.0573	-36.951552	-33.2584	-29.9308	-26.9377	-24.2439			
224	Inventory costs	0.0	-18.73458	-18.73458	-18.73458	-16.8791	-15.1912	-13.8721	-12.3048688	-11.0744	-9.96894	-8.97025	-8.07322			
225	EPCRA Report contracting															
226		0.0	-138.4	-138.4	-138.4	-124.6	-112.1	-100.9	-90.8	-81.7	-73.6	-66.2	-59.6			
227		Performance Impacts (Initiative 7) Establish inventory levels at user / operator level														
228	HW generation		-31.7	-31.7	-31.7	-28.5	-25.7	-23.1	-20.8	-18.7	-16.8	-15.2	-13.8			
229	Inventory level		-9.4	-9.4	-9.4	-8.4	-7.8	-6.8	-6.2	-5.5	-5.0	-4.5	-4.0			
230	Order to ship time		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
231	ISR Part I		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
232	ISR Part II		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0			
233		Initiative costs (Initiative 8) Implement a HM training / awareness program														
234	ITEM	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008			
235	ADP R.5															
236	Software R.5															
237	Supplies R	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4			
238	Initial Inventory (I)															
239	Training R	32	32	32	32	32	32	32	32	32	32	32	32			
240	Facilities (I)															
241	Public relations (R)	0	0	0	0	0	0	0	0	0	0	0	0			
242	Transportation (I)															
243	Staffing (R)	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5			
244		44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9			
245		Costs Impacts (Initiative 8) Implement a HM training / awareness program														
246	Disposal	0	-42.24	-42.24	-42.24	-38.016	-34.2144	-30.783	-27.713664	-24.9423	-22.4481	-20.2033	-18.1829			
247	Procurement	0.0	-28.18	-28.18	-28.18	-25.344	-22.8098	-20.5286	-18.475776	-16.6282	-14.9654	-13.4688	-12.122			
248	Inventory costs	0.0														
249	EPCRA Report contracting															
250		0.0	-70.4	-70.4	-70.4	-63.4	-57.0	-51.3	-46.2	-41.6	-37.4	-33.7	-30.3			
251		Performance Impacts (Initiative 8) Implement a HM training / awareness program														
252	HW generation		-21.1	-21.1	-21.1	-18.0	-16.0	-14.4	-13.9	-12.5	-11.2	-10.1	-9.1			
253	Inventory level		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
254	Order to ship time		0	0	0	0	0	0	0	0	0	0	0			
255	ISR Part I		0	0	0	0	0	0	0	0	0	0	0			
256	ISR Part II		12	12	12	12	12	12	12	12	12	12	12			

Figure H-1. Cost and Benefit Analysis Spreadsheet
(page 4 of 4 pages)

(1) Cost Avoidance Cells

- B2, "Site." This cell contains the name of the organization or installation used for the analysis.

- B3, "HW amount." Cell contains the annual HW generation amount for the organization or installation in thousands of pounds.

- B4, "Reusable waste (reusable assumption \times B3)." Cell contains the annual amount of HW in thousands of pounds that potentially would be reusable. The study used the assumption that 40 percent of HW generated at a site was reusable.

- B5, "Disposal avoidance (disposal cost assumption \times B4)." Cell contains the disposal cost avoidance in thousands of dollars obtained from using the reusable portion of the HW generated.

- B6, "Disposal avoidance + procurement avoidance (B5 \div disposal avoidance ratio assumption)." Cell contains the total of disposal and procurement avoidances in thousands of dollars based on the HW generation.

- B7, "Procurement avoidance (B6 - B5)." Cell contains the procurement avoidance in thousands of dollars.

- B8, "Disposal + procurement avoidance validation (B5 + B7)." Cell recalculates the total of disposal and procurement avoidances in thousands of dollars.

(2) Baseline Operations Costs. These costs establish a baseline against which the HM pharmacy initiative costs and avoidances are compared. These costs are not indicative of the total amount of money currently spent on HM management--they are only calculated for the impacted items associated with the HM pharmacy initiatives used in the analysis.

- J2, "Baseline disposal cost (B3 \times disposal cost assumption)." Cell contains the "as is" baseline costs for HW disposal for the site.

- J3, "Baseline procurement cost (B7 \div reusable amount assumption)." Cell contains the study baseline costs for HM procurement.

- J5, "Baseline inventory level (B3 \times reusable amount assumption)." Cell contains the amount of HM in thousands of pounds that does not need to be stored as HW.

- Row13, "Baseline ADP/hardware costs." Cells contain estimates of operation costs for ADP/hardware without incorporating any study HM initiatives.

- Row 14, "Baseline software costs." Cells contain estimates of operation costs for software without incorporating any study HM initiatives.

- Row 15, "Baseline supply costs." Cells contain estimates of operation costs for supplies without incorporating any study HM initiatives.

- Row 16, "Baseline initial inventory costs." Cells contain estimates of operation costs for an initial inventory without incorporating any study HM initiatives.

- Row 17, "Baseline training costs." Cells contain estimates of operation costs for HM training without incorporating any study HM initiatives.

- Row 18, "Baseline facilities costs." Cells contain estimates of operation costs for facilities without incorporating any study HM initiatives.

- Row 19, "Baseline public relations costs." Cells contain estimates of operation costs for public relations without incorporating any study HM initiatives.

- Row 20, "Baseline transportation costs." Cells contain estimates of operation costs for transportation without incorporating any study HM initiatives.

- Row 21, "Baseline staffing costs." Cells contain estimates of operation costs for staffing without incorporating any study HM initiatives.

- Row 22, "Baseline disposal costs (J2)." Cells contain estimates of operation costs for disposal costs without incorporating any study HM initiatives.

- Row 23, "Baseline procurement costs (J3)." Cells contain estimates of operation costs for procurement costs without incorporating any study HM initiatives.

- Row 24, "Baseline inventory costs (J3 x .2)." Cells contain estimates of operation costs for inventory costs without incorporating any study HM initiatives.

- Row 25, "Baseline EPCRA report contracting." Cells contain the study estimates for contract fees to complete required reports without incorporating HM initiatives.

- Row 27, "Total baseline operations costs (Sum) (row 13 ... row 25) ." Cell contains the total baseline operations costs for HM management. This row is imported to the TurboBPR model as the "as is" costs.

(3) Cost Inputs. Cells B31 to B39 are the costs associated with implementing the HM pharmacy initiatives. These values were established by the ALCHMMI study team and are all in thousands of dollars. The sources for cost input estimates are in Appendix J.

- B31, "ADP/hardware cost." Cell contains cost estimate for ADP. This cost is incurred the first and fifth year of the analysis.

- B32, "Software." Cell contains cost estimate for software costs. This cost is incurred the first and fifth year of the analysis.

- B33, "Supplies." Cell contains cost estimate for HM initiative supplies. This cost is incurred every year of the analysis.

- B34, "Initial inventory." Cell contains estimate for the cost of an initial inventory that might be necessary to implement the HM pharmacy initiatives. This cost is incurred the first year of the analysis.

- B35, "Training." Cell contains cost estimate for HM pharmacy initiative related training. This cost is incurred every year of the analysis.

- B36, "Facilities." Cell contains cost estimates for HM facility purchases or upgrades for HM pharmacy initiatives. This cost is incurred the first year of the analysis.

- B37, "Public relations." Cell contains cost estimates for HM pharmacy initiative public relation expenses. This cost is incurred every year of the analysis.

- B38, "Transportation." Cell contains cost estimates for HM pharmacy initiative transportation needs. This cost is incurred the first year of the analysis.

- B39, "Staffing." Cell contains cost estimates for the new staffing levels for the HM pharmacy initiatives. This cost is incurred every year of the analysis.

(4) Impacted Costs. Cells B40 to B43 are the areas that the HM pharmacy initiatives affect. A negative value indicates a general costs savings/avoidance in that area. A positive value indicates a general cost increase in that area.

- B40, "Disposal baseline cost (cell J2)." Cell contains the "as is" baseline costs for HW disposal for the site. This cost is incurred every year of the analysis.

- B41, "Procurement baseline cost (cell J3)." Cell contains the study baseline costs for HM procurement. This cost is incurred every year of the analysis.

- B42, "Inventory costs = (B7 x .2)." Cell contains inventory cost estimates for HW that should be reduced with HM pharmacy initiatives. The value was calculated by using 20 percent of the procurement avoidance. This cost is incurred every year of the analysis.

- B43, "EPCRA report contracting." Cells contain the study estimates for contract fees to complete required reports without incorporating HM initiatives. This cost is incurred every year of the analysis.

(5) Individual Initiative Costs. These rows show the annual cost associated with each initiative. The costs are based on the cost inputs of cells B31 to B39. The values are calculated by multiplying the cost input by the associated percent breakout for that initiative. The percent breakout for each initiative is shown in Table 2-3. The costs are in thousands of dollars.

- Row 47, "ADP/hardware costs for initiative 1 ($B31 \times$ Initiative percent breakout value)."
- Row 48, "Software costs for initiative 1 ($B32 \times$ Initiative percent breakout value)."
- Row 49, "Supply costs for initiative 1 ($B33 \times$ Initiative percent breakout value)."
- Row 50, "Initial inventory costs for initiative 1 ($B34 \times$ Initiative percent breakout value)."
- Row 51, "Training costs for initiative 1 ($B35 \times$ Initiative percent breakout value)."
- Row 52, "Facilities costs for initiative 1 ($B36 \times$ Initiative percent breakout value)."
- Row 53, "Public relations costs for initiative 1 ($B37 \times$ Initiative percent breakout value)."
- Row 54, "Transportation costs for initiative 1 ($B38 \times$ Initiative percent breakout value)."
- Row 55, "Staffing costs for initiative 1 ($B39 \times$ Initiative percent breakout value)."
- Row 57, "Total initiative costs (Sum) (row 47 ... row 55))." This row calculates the total costs associated with the initiative. The calculations described in rows 47 to 57 are repeated for each HM pharmacy initiative. These rows are imported to the TurboBPR model.

(6) Individual Initiative Cost Impacts. These rows show the annual cost impacts associated with each initiative. The cost impacts are based on the cost inputs of cells B40 to B43. The values are calculated by multiplying the costs by the associated percent breakout for that initiative. The percent breakout for each initiative is shown in Table 2-4. Negative values indicate cost avoidances or savings and costs are in thousands of dollars. The calculations described for rows 59 to 64 are repeated for each HM pharmacy initiative.

- Row 59, "Disposal cost impacts ($B40 \times$ - Initiative percent breakout value)."
- Row 60, "Procurement cost impacts ($B41 \times$ - Initiative percent breakout value)."
- Row 61, "Inventory cost impacts ($B42 \times$ - Initiative percent breakout value)."
- Row 62, "EPCRA report contracting cost impacts ($B43 \times$ - Initiative percent breakout value)."
- Row 64, "Total initiative cost impacts (Sum) (row 59 ... row 62))." This row calculates the total cost impacts associated with the initiative. The calculations described in rows 59 to 62 are repeated for each HM pharmacy initiative. These rows are imported to the TurboBPR model.

(7) Individual Initiative Performance Impacts. These rows show the five performance impacts associated with each initiative. The target goals were established for 1999 except as indicated. Negative values indicate decreases toward the target goals. The calculations described for rows 66 to 70 are repeated for each HM pharmacy initiative.

- Row 66, "HW generation decrease = $(B59 \div 2)$." This row calculates the decrease in HW generation attributed to the initiative in thousands of pounds.

- Row 67, "Inventory level reductions ($J5 \times$ initiative percent breakout)." This row calculates the decrease in HW inventory levels attributed to the initiative in thousands of pounds.

- Row 68, "Order to ship time." This row records the estimated OST time in days resulting from the initiative. This value was subjectively determined by the ALCHMMI study team.

- Row 69, "Installation status report part I." This row records the percent of the ISR Part I standards positively impacted by the incorporation of the HM pharmacy initiative. This value was subjectively determined by the ALCHMMI study team.

- Row 70, "Installation status report part II." This row records the percent of the ISR Part II standards positively impacted by the incorporation of the HM pharmacy initiative. This value was subjectively determined by the ALCHMMI study team.

APPENDIX I

ORGANIZATIONAL LEVEL OF HM PHARMACY IMPLEMENTATION

I-1. INTRODUCTION. This appendix describes the various options of HM pharmacy implementation within an Army installation. The ALCHMMI study team developed five potential options for implementing an HM pharmacy within an installation. An overview and organization chart for the five options will be presented. These options require varying degrees of changes to current business practices. These changes will need to be considered as the options for implementation are assessed.

I-2. BACKGROUND. The HM pharmacy concept implementation options are numerous. Although a true pharmacy generally infers a single point of management and control, that management and control can be obtained in varying degrees and levels depending on the end result desired. The pharmacy concept has the flexibility to accommodate more than one management style. It can be tailored to meet the unique requirements of a specific installation without losing the emphasis originally intended of the concept. A single point of control per installation (fence line) may work at some installations but not at others. The single point of control may be especially conducive to operations at installations other than troop installations where the entire installation and, in most cases, colocated activities are within the same structure, or chain of command. The AMC depots, ammunition plants, and arsenals typify this structure. Some installations may choose to implement a single point of control within each supply and/or financial account on an installation. Others may implement a single point of control within each mission of a supply account. Some tenants may retain their autonomy. Others may determine that support from the installation is more effective and efficient.

I-3. OPTION 1. Option 1 is referred to as "status quo." It represents the typical organization structure and method of operation currently in place at a troop installation today. The entire fence line of an installation is generally the responsibility of MACOM and the staff elements of the MACOM headquarters. The installation may or may not have tenant activities. The tenant activities may or may not fall within the organization or chain of command responsible for the rest of the installation. The organization chart for option 1 is shown in Figure I-1.

NO ORGANIZATIONAL CHANGES
MAJOR SUPPLY ACCOUNTS (HIGHLIGHTED) REMAIN SEPARATE

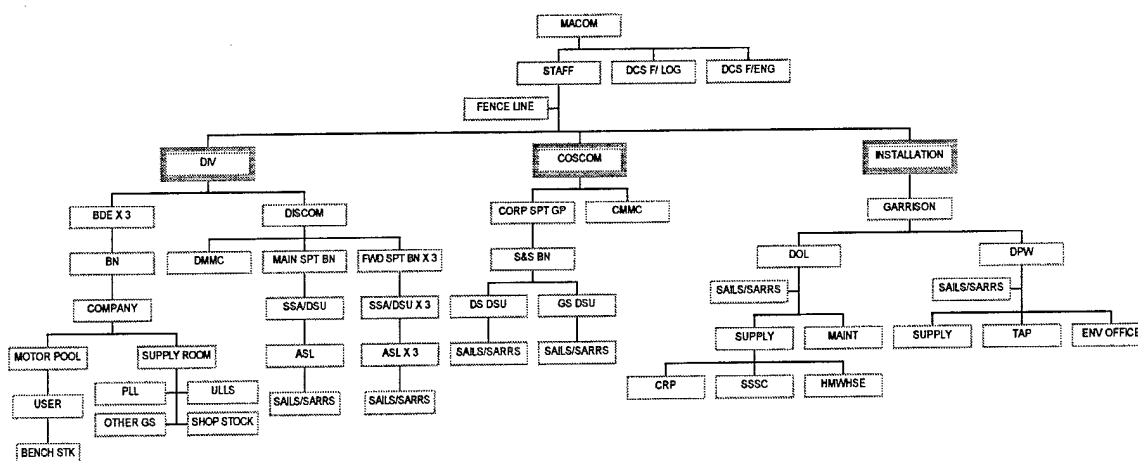


Figure I-1. Option 1 - Status Quo

a. Description. A troop installation has multiple supply and/or financial accounts all generally operating independently of one another and focused on a particular mission. Division assets and the corps support command (COSCOM) are normally tenant activities that function outside the installation and/or garrison chain of command even though they are physically located within the fence line. The division support command (DISCOM) provides support to the division assets while the COSCOM is a backup to the DISCOM and supports nondivision assets within its assigned area. The garrison is normally supported by the Director of Logistics (DOL) and the Director of Public Works, and in some cases the Defense Logistics Agency (DLA). The DOL or DLA normally operates an installation central receiving point that may receive incoming material for processing and distribution, or throughput to each supply account.

b. Potential Impacts. Current limitations or perceived shortfalls associated with the existing organization operation include the inability to readily satisfy all environmental program reporting requirements, and the minimal cross-leveling of material accomplished within or between supply accounts. Cross-leveling for the purpose of this study refers to the exchange of material between supply accounts. That is, if one supply account requires material that is currently available but not needed (in the short term) in another account, the material is provided where it is needed rather than processing a new requisition to procure additional material. Minimal cross-leveling is done currently, primarily for two reasons: a lack of visibility between accounts, and financial accounting problems associated with the exchange of material between accounts.

I-3. OPTION 2. Option 2 provides an HM control center (HMCC) at the supply support activity (SSA) or direct support unit (DSU), or equivalent (i.e., DOL or DPW), level. HM issue points are at the shop level directly supporting a specific mission. The HMCC may be set up to

provide only administrative (acquisition, inventory, life cycle management, and disposal) control/support of HM, or it may be a combined administrative and physical (receipt, storage, issue) control area. The HMCC is generally made up of representatives from all of the organizations that are responsible for, or have a vested interest in, tracking and control of HM. The organization chart for option 2 is shown in Figure I-2.

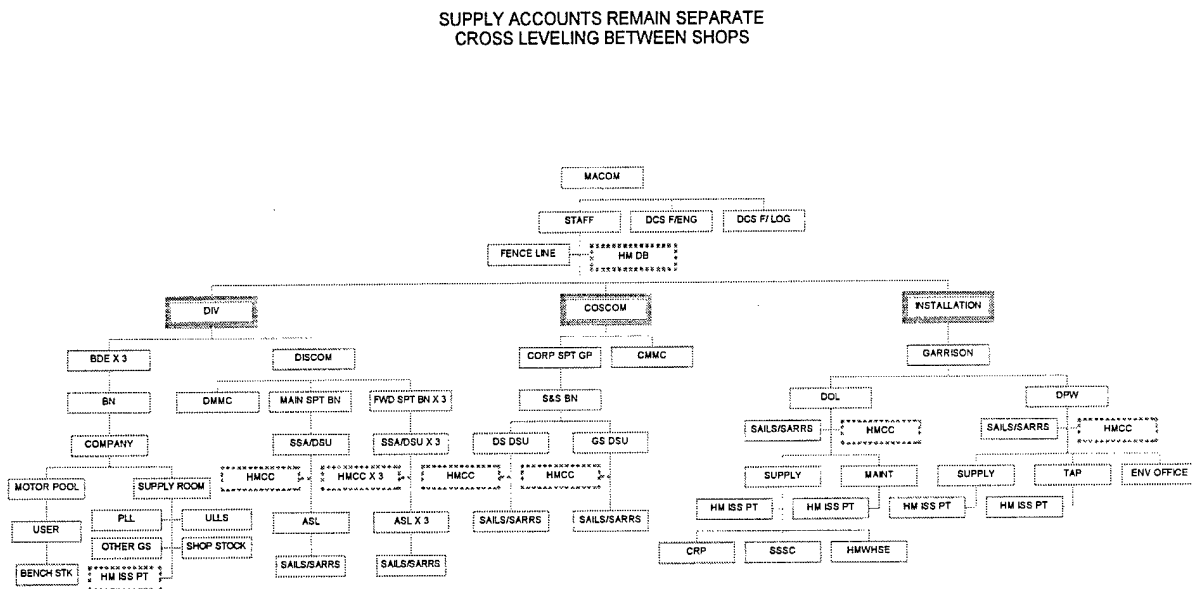


Figure I-2. Option 2 - HMCC Control

a. Description. The DOL and the DPW may continue to manage their programs separately, with HM issue points established as needed to support each mission within their accounts. A centralized data base is intended to capture all HM information for all activities within the fence line. The location of the data base and the structure to support it is optional.

b. Potential Impacts. This option allows some centralized management at the SSA (or equivalent) level, and cross-leveling of stocks within shops serviced by one HMCC. No cross-leveling between SSA/DSU, or between DOL and DPW is required. The separation in supply and/or financial accounts is retained. Some business practice changes are required at the SSA (or equivalent) and issue point level to accommodate the additional emphasis, or intensive management, required to support the HM program.

I-4. OPTION 3. Option 3 provides an HMCC for centralized management within each supply and/or financial account including a single HMCC at the installation/garrison level. The issue points may be set up at the SSA/DSU, DOL, and DPW level. The centralized data base again captures information for all activities within the fence line, and the location of the data base is still optional. The supply and/or financial accounts remain separate and continue to operate independent of each other. Some cross-leveling will take place and is accomplished between

missions within each supply account, but not between supply accounts. The organization chart for Option 3 is shown in Figure I-3.

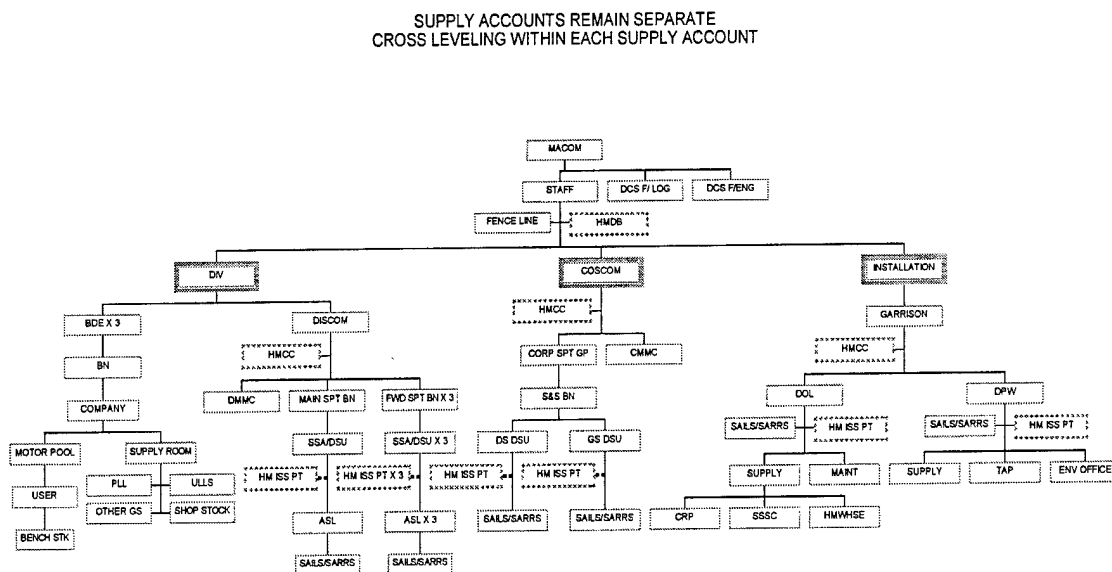


Figure I-3. Option 3 - HMCC Control and Storage

a. Description. At the installation/garrison level, a single HMCC has overall HM management responsibility for HM within the installation/garrison account. Separate issue points may be provided for DOL and DPW to facilitate operations at the mission level for both. The HMCC may be made up of multifunctional personnel from DOL, DPW, and others having a vested interest in the HM program management.

b. Potential Impacts. Although not indicated on the chart, satellite issue points are optional and may be utilized at varying levels below the primary issue point noted. This may make the issue points more readily accessible to the mission areas. Some additional business practice changes may be required to accommodate the additional intensive management of HM.

I-5. OPTION 4. Option 4 provides centralized management for all assets within the fence line. The location for the centralized management cell is optional but ideally will consist of multifunctional personnel from organizations that currently have a role to play in HM management. The centralized data base is still intended to capture information from all activities within the fence line. The location of the data base remains optional, but it would probably be maintained within the centralized management cell. The organization chart for Option 4 is shown in Figure I-4.

SUPPLY ACCOUNTS CO-MINGLED
CROSS LEVELING DONE BETWEEN MAJOR SUPPLY ACCOUNTS

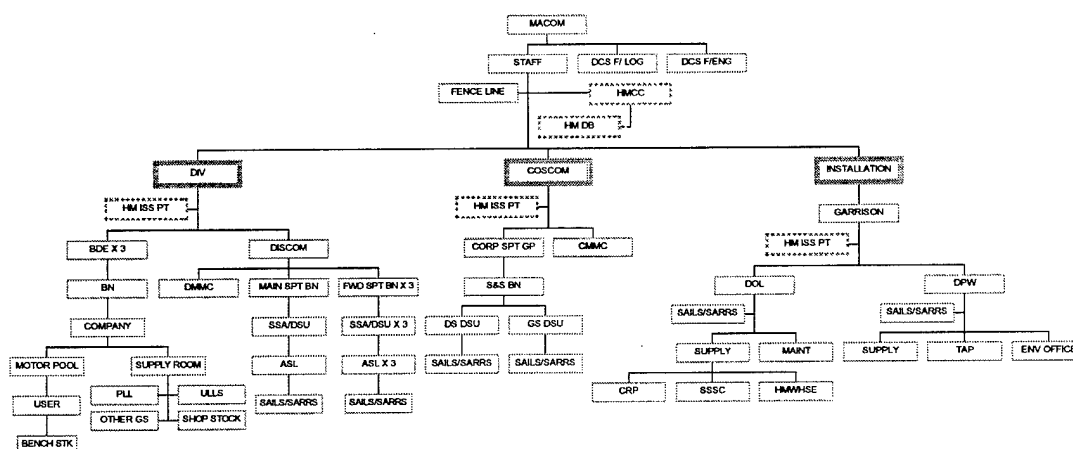


Figure I-4. Option 4 - HMCC and Installation Storage

a. Description. Issue points may be set up at the supply and/or financial account level. Satellite issue points can be used as needed. Cross-leveling may be accomplished within or between supply and/or financial accounts. Some significant changes to current business practices may be required. In addition to the changes necessitated by the HM intensive management, it would be necessary to revise financial accounting procedures/policy. The policy would have to provide a mechanism to account for HM initially requisitioned and bought by one supply account and consumed by another account. An audit and consumption trail for the HM will need to be maintained for possible reimbursement.

b. Potential Impacts. This option should offer the greatest potential for payback. However, it may not be achievable early in the HM pharmacy implementation process until some measure of experience and knowledge is gained through implementation of one of the options mentioned previously.

I-6. OPTION 5. Option 5 is implementation of the automated HM data base system only. The centralized data base captures information for all activities within the fence line. This option infers a virtual pharmacy because there is some measure of centralized oversight potential to be gained via implementation of the automated data network. In actuality, few of the potential benefits, associated with the intensive management inherent in a true pharmacy effort, would be achievable. The organization chart for Option 5 is shown in Figure I-5.

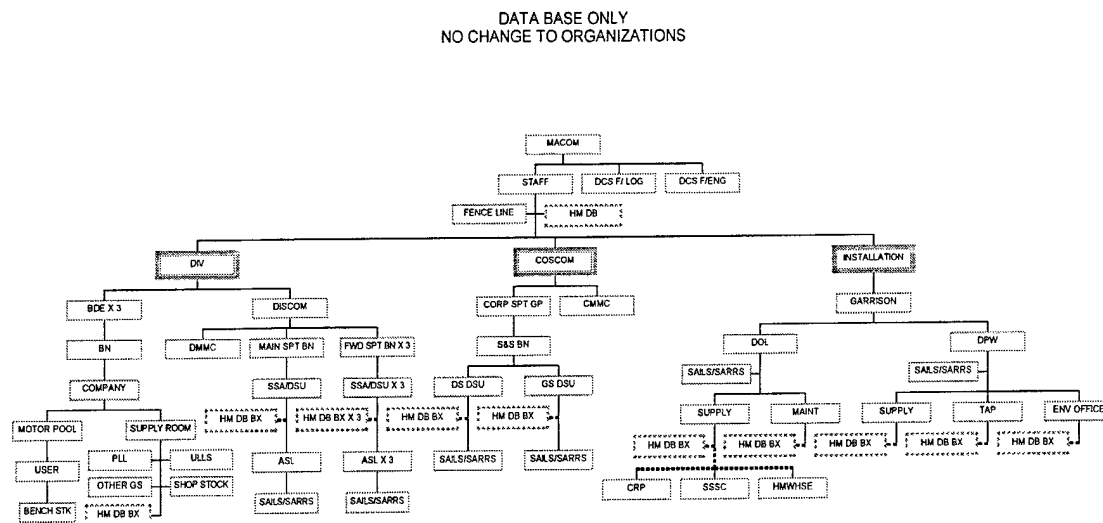


Figure I-5. Option 5 - Virtual Pharmacy

a. Description. This option will provide very little change from the current method of operation. Once again, the location of the centralized data base is optional. The supply and/or financial accounts remain separate. Information for all activities within the fence line would be gathered at the user/shop and SSA/DSU level, but cross-leveling will probably not take place. HM data base terminals or hardware/software would be set up to gather the information at the shop and servicing SSA/DSU level. Shop level input will be needed to gather consumption data at the user level. Minimal business practice changes (other than the increased level of automated data effort required by the users) are required. The additional effort at the user/shop level and at each place a terminal is placed is needed to routinely update the data base. With no centralized management, the responsibility to maintain the integrity of the HM related data transactions falls back to the user level. No centralized management would probably mean that little, if any, cross-leveling of material would take place even if the data that would facilitate cross-leveling is available.

b. Potential Impacts. The primary benefit of this option is the automated data base which would benefit the environmental program via expediting, or making more readily available, the data needed to satisfy environmental reporting. This options seems to offer little benefit to the logistics community other than providing potential asset visibility down below the shop, or shop stock level, to the user, or bench stock level.

APPENDIX J

ASSUMPTIONS

J-1. INTRODUCTION. This appendix provides listings of the key assumptions used during the ALCHMMI Study. The assumptions are categorized as: (1) Cost Data (2) Cost and Benefit Analysis Approach, and (3) Economic Analysis. Most of the assumptions can be modified for site specific analysis.

J-2. COST DATA. Table J-1 identifies key information pertaining to the baseline cost data used in the cost and benefit analysis.

Table J-1. Cost Data Assumptions

Item	Type cost	Assumptions/constraints	Sources	Notes
ADP/hardware	Initial, 5-year recurring	\$10,000. Based on one standalone system consisting of the following items (computer - \$2,000), (laser printer - \$1,700), (barcode scanner - \$350), (heavy duty barcode printer - \$3,000), (portable barcode reader - \$2,500).	Hazardous Substance Management System (HSMS) implementation plan cost estimates for ADP	No LAN or satellite site equipment included
Software	Initial, 5-year recurring	\$450	Hazardous Substance Management System (HSMS) implementation plan cost estimates for ADP	Off-the-shelf software can be obtained with negligible expense.
General office supplies	Recurring	\$2,000. All standard office supplies will already be available. This estimate includes additional items such as barcode paper, etc.	Business case analysis: FISC HM reutilization operations	
Initial inventory	Initial	\$0. It was assumed that an Army installation could acquire enough of an initial inventory with turn-in of excess materials.	Subjective study team assessment based on site visits.	
Training	Recurring	\$40,000. Assumed a value of \$4K per Pharmacy employee	Business case analysis: FISC HM reutilization operations	
Facility alterations/construction	Initial	\$115,000. Assumed that each installation would have to purchase five hazardous material storage buildings at a cost of \$23K each	Subjective study team assessment based on site visits. Costs of storage buildings can be obtained in flammable liquids storage cabinets (lockers) GSA contract catalog	Storage facilities already exist at most installations
Public relations	Recurring	\$2,000. Assume a cost of \$2K for the following: fliers, videos, newspaper articles, etc.	Business case analysis: FISC HM reutilization operations	Public relations is a critical aspect of the pharmacy concept
Staffing	Recurring	\$250,000. Assumed that a new staff of approximately 10 people will be needed to implement the pharmacy concept. The average salary used was \$25K	The number of personnel used is a subjective study team assessment based on site visits	Business case analysis: FISC HM reutilization operations estimates were similar
Transportation	Initial	\$50,000. Assumed an approximate cost of \$50K for: pickup truck, forklift, etc.	Business case analysis: FISC HM reutilization operations	Vehicles and equipment should be available at most installations.

J-3. COST AND BENEFIT ANALYSIS APPROACH. Table J-2 lists the assumptions and sources related to the cost and benefit analysis approach. These are the assumptions need to relate an installation's HW generation data to overall cost avoidances.

Table J-2. Cost and Benefit Analysis Approach Assumptions

Assumptions/constraints	Sources
Hazardous waste generated (lbs)	Army Compliance Tracking System 1994 HW generation and disposal tracking reports data reported in 1995
40% of HW currently disposed is excess/reusable material	(1) Abbreviated System Decision Paper (Navy), Sep 94 (2) GAO report Hazardous Waste "Attention to DOD Inventories of Hazardous Materials Needed," Nov 89
\$2/lb Disposal cost avoidance factor	Department of Public Works average cost of disposal amount FISC San Diego
60% of (disposal + procurement avoidance) is disposal avoidance	(1) Abbreviated System Decision Paper, Sep 94 NAVSUP cost-benefit analysis (2) 3-year calculations from FISC San Diego show approximately 60% of total avoidance is disposal avoidance
40% of (disposal + procurement avoidance) is procurement avoidance	(1) Abbreviated System Decision Paper, Sep 94 NAVSUP cost-benefit analysis (2) 3-year calculations from FISC San Diego show approximately 45% of total avoidance is disposal avoidance
Baseline disposal costs	Based on 100% of waste being disposed @ \$2.00/lb Department of Public Works average cost of disposal amount FISC San Diego
Baseline procurement costs	Based on 40% of procurement value of hazardous materials representing unused materials. GAO report Hazardous Waste, "Attention to DOD Inventories of Hazardous Materials Needed," Nov 89
Initiative costs	Results of ALCHMMI study working group
Initiative costs/benefits impacts (percent breakout)	Results of ALCHMMI study working group
Benefit reduction	10% decrease of benefits each year after year 3. ALCHMMI study working group
No initiative interaction	ALCHMMI study working group and model limitation
Inventory & storage costs	Based on 20 percent of procurement cost. ALCHMMI study working group

J-4. ECONOMIC ANALYSIS. Table J-3 lists the general assumptions that are adjustable in TurboBPR for performing economic analysis.

Table J-3. Economic Analysis Assumptions

Assumptions/constraints	Sources
2.8% Discount factor	Office of Management and Budget discount factor used for projects with an economic life of 10 years "Revised Discount Rates for Use in Economic Analysis"
10-Year economic life	ALCHMMI study working group
20% Initiative cost and performance impacts range for sensitivity analysis	ALCHMMI study working group

APPENDIX K

CASE STUDY: SAMPLE INSTALLATION

K-1. INTRODUCTION. This case study documents the ALCHMMI cost and benefit analysis approach used to provide cost and benefit analysis information to representatives of a sample installation environmental staff. This appendix describes a portion of the analysis provided to an Army installation that requested assistance in performing a cost and benefit analysis.

K-2. PURPOSE. The purpose of the case study is to demonstrate an application of the ALCHMMI Study cost and benefit analysis approach utilizing data provided by an actual Army installation.

K-3. DATA. A data worksheet shown in Figure K-1 was completed by the installation representatives describing their specific costs and HW inputs. This data worksheet allowed the installation representatives to annotate their specific data in lieu of the ALCHMMI study team "generic" data utilized in the study report.

INSTALLATION	
HAZARDOUS WASTE AMOUNT (LBS)	320,057 - hazardous/regulated waste generated in CY 1994
HARDWARE	\$17,042 - we're keeping the same hardware as we had for the pilot project
SOFTWARE	Zero- this assumes that we are starting up without HSMS or anything other than HICS
SUPPLIES	\$16,100
TRAINING	\$6,000
FACILITIES	\$300,000 - this includes the safety storage units purchased for the pilot program, renovation on the warehouse that we're converting, and design for same
PUBLIC RELATIONS	\$2,000
TRANSPORTATION	\$50,000 - includes delivery vehicle and forklift
STAFFING	\$136,000 - includes HAZMART manager, two handlers, and one computer operator (annual)
INITIAL INVENTORY	Zero - inventory will be built from "A" condition material collections. Additional stock will be user-funded and not an operational cost
ADDITIONAL COSTS	\$60,000 - cost for the contractor to assist us with the cleanout/AUL development (one-time cost)
REMARKS	

Figure K-1. Data Worksheet

The cost and benefit analysis spreadsheet was altered to reflect the installation data. The sample Installation updated spreadsheet is shown in Figure K-2.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	INPUTS							Baseline Costs							
2	Site	Sample Data						Disposal	\$ 640	Based on 100% of waste being disposed at \$2.00/lb					
3	HW amount (000 lbs)	320.057						Procurement	\$ 427	Based on 40% of material not required to be purchased again					
4	40% of HW	128.0228													
5	Disposal avoidance	\$ 256.05							128.023	How much material is not needed to store or handle					
6	Total Avoidance	\$ 426.74													
7	Procurement avoid	\$ 170.70													
8	Validation	\$ 426.74													
9															
10															
11	ITEM COSTS														
12															
13	ADP R.5	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
14	Software R.5	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
15	Supplies R	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
16	Initial Inventory (I)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
17	Training R	\$ 40	\$ 40	\$ 40	\$ 40	\$ 40	\$ 40	\$ 40	\$ 40	\$ 40	\$ 40	\$ 40	\$ 40	\$ 40	\$ 40
18	Facilities (I)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
19	Public relations (R)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
20	Transportation (I)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
21	Staffing (R)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
22	Disposal (R)	\$ 640	\$ 640	\$ 640	\$ 640	\$ 640	\$ 640	\$ 640	\$ 640	\$ 640	\$ 640	\$ 640	\$ 640	\$ 640	\$ 640
23	Procurement (R)	\$ 427	\$ 427	\$ 427	\$ 427	\$ 427	\$ 427	\$ 427	\$ 427	\$ 427	\$ 427	\$ 427	\$ 427	\$ 427	\$ 427
24	Inventory costs R	\$ 85	\$ 85	\$ 85	\$ 85	\$ 85	\$ 85	\$ 85	\$ 85	\$ 85	\$ 85	\$ 85	\$ 85	\$ 85	\$ 85
25	EPCRA Report contracting R	\$ 60	\$ 60	\$ 60	\$ 60	\$ 60	\$ 60	\$ 60	\$ 60	\$ 60	\$ 60	\$ 60	\$ 60	\$ 60	\$ 60
26															
27		\$ 1,252	\$ 1,252	\$ 1,252	\$ 1,252	\$ 1,252	\$ 1,252	\$ 1,252	\$ 1,252	\$ 1,252	\$ 1,252	\$ 1,252	\$ 1,252	\$ 1,252	\$ 1,252
28															
29	Pharmacy costs														
30	ADP R.5	\$ 17.04													
31	Software R.5	\$ 17.04													
32	Supplies R	\$ 17.04													
33	Initial Inventory (I)	\$ 17.04													
34	Training R	\$ 17.04													
35	Facilities (I)	\$ 17.04													
36	Public relations (R)	\$ 17.04													
37	Transportation (I)	\$ 17.04													
38	Staffing (R)	\$ 17.04													
39	Disposal (ops)	\$ 17.04													
40	Procurement (ops)	\$ 17.04													
41	Inventory costs	\$ 17.04													
42	EPCRA Report contracting	\$ 17.04													
43															
44															
45	Initiative costs (Initiative 1) Establish reuse procedures														
46	ITEM														
47	ADP R.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	Software R.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	Supplies R	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	Initial Inventory (I)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	Training R	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	Facilities (I)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	Public relations (R)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
54	Transportation (I)	10	10	10	10	10	10	10	10	10	10	10	10	10	10
55	Staffing (R)	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
56		77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2
57															
58	Cost Impacts (Initiative 1) Establish reuse procedures														
59	Disposal	0	-76.81368	-76.81368	-76.8137	-89.13231	-82.2191	-55.0972	-50.3974554	-45.3577	-40.8210	-36.7397	-33.0656		
60	Procurement	0	-34.1384133	-34.13841	-34.1384	-30.72547	-27.8529	-24.8876	-22.3988691	-20.159	-18.1431	-16.3286	-14.6959		
61	Inventory costs	0	-5.70126203	-5.701282	-5.70128	-5.131154	-4.61804	-4.15623	-3.74061114	-3.36855	-3.0299	-2.72691	-2.45421		
62	EPCRA Report contracting														
63															
64		0.0	-116.7	-116.7	-116.7	-105.0	-94.5	-85.0	-76.5	-68.9	-62.0	-55.8	-50.2		
65	Performance Impacts (Initiative 1) Establish reuse procedures														
66	HW generation		-38.4	-38.4	-38.4	-34.8	-31.1	-28.0	-25.2	-22.7	-20.4	-18.4	-16.5		

Figure K-2. Sample Installation Updated Spreadsheet
(page 1 of 4 pages)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
67	Inventory level		-2.9	-2.9	-2.9	-2.9	-2.3	-2.1	-1.9	-1.7	-1.5	-1.4	-1.2			
68	Order to ship time		0.0	0.0	0.0											
69	ISR Part I		0.0	0.0	0.0											
70	ISR Part II		4.8	4.8	4.8											
71																
72		Initiative costs (Initiative 2) Order / dispense by unit of use vs unit of issue														
73	ITEM	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008			
74	ADP R.5															
75	Software R.5															
76	Supplies R	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22			
77	Initial inventory (I)															
78	Training R															
79	Facilities (I)															
80	Public relations (R)															
81	Transportation (I)	10	0	0	0	0	0	0	0	0	0	0	0			
82	Staffing (R)	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8			
83																
84		20.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02			
85		Cost impacts (Initiative 2) Order / dispense by unit of use vs unit of issue														
86																
87	Disposal	0	-38.40684	-38.40684	-38.40684	-34.56616	-31.1095	-27.9988	-25.1987277	-22.6788	-20.411	-18.3899	-16.5329			
88	Procurement	0	0	0	0	0	0	0	0	0	0	0	0			
89	Inventory costs	0	-5.70128203	-5.701282	-5.70128	-5.131154	-4.61804	-4.15823	-3.74061114	-3.36655	-3.0299	-2.72661	-2.45421			
90	EPCRA Report contracting	0														
91																
92		0	-44.108122	-44.10812	-44.1081	-39.69731	-35.7276	-32.1548	-28.9393389	-26.0454	-23.4409	-21.0968	-18.9671			
93		Performance impacts (Initiative 2) Order / dispense by unit of use vs unit of issue														
94	HW generation		-19.2	-19.2	-19.2	-17.3	-15.6	-14.0	-12.6	-11.3	-10.2	-9.2	-8.3			
95	Inventory level		-2.9	-2.9	-2.9	-2.8	-2.3	-2.1	-1.9	-1.7	-1.5	-1.4	-1.2			
96	Order to ship time		0	0	0											
97	ISR Part I		0	0	0											
98	ISR Part II		2.4	2.4	2.4											
99																
100		Initiative costs (Initiative 3) Establish centralized issue / storage points														
101	ITEM	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008			
102	ADP R.5	2.5563					2.5563									
103	Software R.5	0					0									
104	Supplies R	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22			
105	Initial inventory (I)															
106	Training R															
107	Facilities (I)	240														
108	Public relations (R)															
109	Transportation (I)	30														
110	Staffing (R)	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6			
111																
112		323.3763	50.82	50.82	50.82	50.82	53.3763	50.82	50.82	50.82	50.82	50.82	50.82			
113		Cost impacts (Initiative 3) Establish centralized issue / storage points														
114	Disposal															
115	Procurement															
116	Inventory costs															
117	EPCRA Report contracting															
118																
119		0	0	0	0	0	0	0	0	0	0	0	0			
120		Performance impacts (Initiative 3) Establish centralized issue / storage points														
121	HW generation		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
122	Inventory level		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
123	Order to ship time		-14.5	-14.5	-14.5											
124	ISR Part I		0	0	0											
125	ISR Part II		24	24	24											
126																
127		Initiative costs (Initiative 4) Establish centralized HM management cell														
128	ITEM	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008			
129	ADP R.5	2.5563					2.5563									
130	Software R.5	0					0									
131	Supplies R	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22			
132	Initial inventory (I)															

Figure K-2. Sample Installation Updated Spreadsheet
(page 2 of 4 pages)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
133	Training R	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6			
134	Facilities (I)															
135	Public relations (R)	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6			
136	Transportation (I)															
137	Staffing (R)	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6			
138																
139		55.5763	53.02	53.02	53.02	53.02	55.5763	53.02	53.02	53.02	53.02	53.02	53.02			
140	Cost impacts (Initiative 4) Establish centralized HM management cell															
141	Disposal	0	-38.40684	-38.40684	-38.40684	-34.56616	-31.1095	-27.9988	-25.1987277	-22.6789	-20.411	-18.3699	-16.5329			
142	Procurement	0.0	-34.1394133	-34.13941	-34.1394	-30.72547	-27.6529	-24.8878	-22.3988691	-20.159	-18.1431	-16.3288	-14.6959			
143	Inventory costs	0.0	-5.70128203	-5.701282	-5.70128	-5.131154	-4.61804	-4.15823	-3.74061114	-3.36855	-3.0299	-2.72691	-2.45421			
144	EPCRA Report contracting	0.0	-19.98	-19.98	-19.98	-17.982	-16.1638	-14.5854	-13.10878	-11.798	-10.6182	-9.55637	-8.60073			
145																
146		0.0	-99.2	-99.2	-99.2	-88.4	-79.6	-71.8	-64.4	-58.0	-52.2	-47.0	-42.3			
147	Performance impacts (Initiative 4) Establish centralized HM management cell															
148	HW generation		-19.2	-19.2	-19.2	-17.3	-15.6	-14.0	-12.6	-11.3	-10.2	-9.2	-8.3			
149	Inventory level		-2.9	-2.9	-2.9	-2.6	-2.3	-2.1	-1.9	-1.7	-1.6	-1.4	-1.2			
150	Order to ship time		0.0	0.0	0.0											
151	ISR Part I		0.0	0.0	0.0											
152	ISR Part II		45.0	45.0	45.0											
153																
154	Initiative costs (Initiative 5) Establish authorized user / use list															
155	ITEM	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008			
156	ADP R.5															
157	Software R.5															
158	Supplies R															
159	Initial inventory (I)															
160	Training R															
161	Facilities (I)															
162	Public relations (R)															
163	Transportation (I)															
164	Staffing (R)	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8			
165																
166		6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8			
167	Cost impacts (Initiative 5) Establish authorized user / use list															
168	Disposal	0	0	0	0	0	0	0	0	0	0	0	0			
169	Procurement	0.0	-17.0697067	-17.06971	-17.0697	-15.36274	-13.8265	-12.4438	-11.1994345	-10.0795	-9.07154	-8.16439	-7.34795			
170	Inventory costs	0.0	-5.70128203	-5.701282	-5.70128	-5.131154	-4.61804	-4.15823	-3.74061114	-3.36855	-3.0299	-2.72691	-2.45421			
171	EPCRA Report contracting															
172		0.0	-22.8	-22.8	-22.8	-20.5	-18.4	-16.6	-14.9	-13.4	-12.1	-10.9	-9.8			
173																
174	Performance impacts (Initiative 5) Establish authorized user / use list															
175	HW generation		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
176	Inventory level		-2.9	-2.9	-2.9	-2.6	-2.3	-2.1	-1.9	-1.7	-1.6	-1.4	-1.2			
177	Order to ship time		0.00	0.00	0.00											
178	ISR Part I		0.00	0.00	0.00											
179	ISR Part II		16.80	16.80	16.80											
180																
181	Initiative costs (Initiative 6) Implement a tracking system															
182	ITEM	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008			
183	ADP R.5	11.9294					11.9294									
184	Software R.5	0					0									
185	Supplies R	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22			
186	Initial inventory (I)															
187	Training R															
188	Facilities (I)															
189	Public relations (R)															
190	Transportation (I)															
191	Staffing (R)	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8			
192																
193		21.9494	10.02	10.02	10.02	10.02	21.9494	10.02	10.02	10.02	10.02	10.02	10.02			
194	Cost impacts (Initiative 6) Implement a tracking system															
195	Disposal	0	-38.40684	-38.40684	-38.4068	-34.56616	-31.1095	-27.9988	-25.1987277	-22.6789	-20.411	-18.3699	-16.5329			
196	Procurement	0.0	-34.1394133	-34.13941	-34.1394	-30.72547	-27.6529	-24.8878	-22.3988691	-20.159	-18.1431	-16.3288	-14.6959			
197	Inventory costs															
198	EPCRA Report contracting	0.0	-40.02	-40.02	-40.02	-36.018	-32.4182	-28.1746	-26.257122	-23.6314	-21.2683	-19.1414	-17.2273			

Figure K-2. Sample Installation Updated Spreadsheet
(page 3 of 4 pages)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
199																
200		0.0	-112.6	-112.6	-112.6	-101.3	-91.2	-82.1		-73.0	-66.5	-59.8	-53.8	-48.5		
201		Performance impacts (Initiative 6) Implement a tracking system														
202	HW generation		-19.2	-19.2	-19.2	-17.3	-15.6	-14.0		-12.6	-11.3	-10.2	-9.2	-8.3		
203	Inventory level		0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0		
204	Order to ship time		0.0	0.0	0.0											
205	ISR Part I		0.0	0.0	0.0											
206	ISR Part II		22.0	22.0	22.0											
207																
208		Initiative costs (Initiative 7) Establish inventory levels at user/operator level														
209	ITEM	1997	1998	1999	2000	2001	2002	2003		2004	2005	2006	2007	2008		
210	ADP R.5															
211	Software R.5															
212	Supplies R															
213	Initial inventory (I)															
214	Training R															
215	Facilities (F)															
216	Public relations (R)															
217	Transportation (T)															
218	Staffing (R)		6.8	6.8	6.8	6.8	6.8	6.8		6.8	6.8	6.8	6.8	6.8		
219																
220		6.8	6.8	6.8	6.8	6.8	6.8	6.8		6.8	6.8	6.8	6.8	6.8		
221		Costs impacts (Initiative 7) Establish inventory levels at user/operator level														
222	Disposal	0	-38.40684	-38.40684	-38.40684	-34.58616	-31.1005	-27.8088		-25.1987577	-22.6789	-20.411	-18.3699	-16.5329		
223	Procurement	0	-34.1394133	-34.13941	-34.1394	-30.72547	-27.6529	-24.8879		-22.3988691	-20.159	-18.1431	-16.3288	-14.6959		
224	Inventory costs	0.0	-11.3684248	-11.36842	-11.3684	-10.23158	-9.20842	-8.29758		-7.46882341	-6.71294	-6.04165	-5.43748	-4.89373		
225	EPCRA Report contracting															
226																
227		0.0	-83.9	-83.9	-83.9	-75.5	-68.0	-61.2		-55.1	-49.0	-44.6	-40.1	-36.1		
228		Performance impacts (Initiative 7) Establish inventory levels at user/operator level														
229	HW generation		-19.2	-19.2	-19.2	-17.3	-15.6	-14.0		-12.6	-11.3	-10.2	-9.2	-8.3		
230	Inventory level		-5.7	-5.7	-5.7	-5.1	-4.6	-4.1		-3.7	-3.4	-3.0	-2.7	-2.4		
231	Order to ship time		0.0	0.0	0.0											
232	ISR Part I		0.0	0.0	0.0											
233	ISR Part II		12.0	12.0	12.0											
234																
235		Initiative costs (Initiative 8) Implement a HM training/awareness program														
236	ITEM	1997	1998	1999	2000	2001	2002	2003		2004	2005	2006	2007	2008		
237	ADP R.5															
238	Software R.5															
239	Supplies R	3.22	3.22	3.22	3.22	3.22	3.22	3.22		3.22	3.22	3.22	3.22	3.22		
240	Initial inventory (I)															
241	Training R	4.8	4.8	4.8	4.8	4.8	4.8	4.8		4.8	4.8	4.8	4.8	4.8		
242	Facilities (F)															
243	Public relations (R)	0	0	0	0	0	0	0		0	0	0	0	0		
244	Transportation (T)															
245	Staffing (R)	6.8	6.8	6.8	6.8	6.8	6.8	6.8		6.8	6.8	6.8	6.8	6.8		
246																
247		14.82	14.82	14.82	14.82	14.82	14.82	14.82		14.82	14.82	14.82	14.82	14.82		
248		Costs impacts (Initiative 8) Implement a HM training/awareness program														
249	Disposal	0	-25.80458	-25.80458	-25.8046	-23.0441	-20.7387	-18.8657		-16.7991518	-15.1182	-13.8073	-12.2486	-11.0219		
250	Procurement	0.0	-17.0897087	-17.08971	-17.0897	-15.36274	-13.8285	-12.4438		-11.1994345	-10.0785	-9.07154	-8.16439	-7.34785		
251	Inventory costs															
252	EPCRA Report contracting															
253																
254		0.0	-42.7	-42.7	-42.7	-38.4	-34.6	-31.1		-28.0	-25.2	-22.7	-20.4	-18.4		
255		Performance impacts (Initiative 8) Implement a HM training/awareness program														
256	HW generation		-12.8	-12.8	-12.8	-11.5	-10.4	-9.3		-8.4	-7.6	-6.8	-6.1	-5.5		
257	Inventory level		0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0		
258	Order to ship time		0	0	0											
259	ISR Part I		0	0	0											
260	ISR Part II		12	12	12											

Figure K-2. Sample Installation Updated Spreadsheet
(page 4 of 4 pages)

K-4. RESULTS. The analysis for the installation was based on the implementation of all eight ALCHMMI study initiatives. This combination of initiatives was identified as Alternative A. A list of the initiatives is shown in Table K-1.

Table K-1. Sample Installation Initiatives

Initiative name	Baseline	Alternative A
I1 Establish reuse center	No	Yes
I2 Order dispense unit of use vs unit of issue	No	Yes
I3 Establish centralized issue and storage points	No	Yes
I4 Centralized management cell	No	Yes
I5 AUL	No	Yes
I6 Tracking system	No	Yes
I7 Establish inventory levels	No	Yes
I8 Training	No	Yes

The results of the cost and benefit analysis can be seen in Table K-2. Table K-2 shows the NPV and discounted payback for the sample installation.

Table K-2. Summary of Cost and Benefit Analysis Results

	Net present value (millions of dollars)			Discounted payback (years)
	Low	Base	High	
Sample installation	1.15	1.44	1.73	2.68

K-5. ANALYSIS The results show that incorporating all eight initiatives at the sample installation have the potential to be an economically justifiable decision. The data provided by the installation shows that their installation has a relatively high volume of HW projected to be generated and would benefit from the HM pharmacy initiatives. Alternatives for the facility replacement/upgrade might warrant reconsideration. The alternative could be enhanced financially if the facility costs were reduced.

K-6. SUMMARY This analysis demonstrates a potential application of the ALCHMMI cost and benefit analysis approach. This shows that the approach has the potential to be transferable to other Army installations.

APPENDIX L

SPONSOR'S COMMENTS

STUDY CRITIQUE

1. Are there any editorial comments? No
2. Identify any key issues planned for analysis that are not adequately addressed in the report. Indicate the scope of the additional analysis needed. Key issues planned for the analysis were met, but if the customer was to be Army installation staffs instead of ACSIM/DCSLOG then the analysis mechanics must change.
3. How can the methodology used to conduct the study be improved? TurboBPR should not be used if the installation staff is the final customer. Army installations need cost benefit results to convince local leadership to change business practices or continue current hazardous material business practices. TurboBPR is a good tool but it is difficult to use by individuals that have no experience with this type of tool. The study methodology of a cross-functional team of logisticians (LIA) environmental (AEC) and compliance (ECAS) experience (CHPPM) was superb and needs to be emulated at the installation level to see real results from the study. Installations are looking for quick answers from TurboBPR and are missing the opportunity to find efficiencies in hazardous material management by simply working in groups that do not normally meet. If installations develop their cross-functional team, visit the hazardous waste collection points (to see the amount of re-usable material), visit sites on the installation that use HAZMAT (DOL Maintenance shops, AVIM units, etc), collect information from LOG, RM and DOC on the cost of materials coming onto the installation, and develop site specific metrics (using the CAA report as a model) then they can develop the business practices that will be the best fit for their situation. Need a tool for an installation cross-functional team to easily use (meaning one where assumptions and cost/benefit percentage breakout are easily modified) for this methodology to be useful for installations that who need this information. Recommend that a section be incorporated in the report that gives clear and simple directions on how to change the Excel spreadsheet cells in the TurboBPR model for the installations to change the model to fit their particular situation. One consistent finding of the study was that there was no information available on the cost of current hazardous material business practices. There is a need at the installation level for this kind of tool, but current configuration of TurboBPR will not allow installations to easily change parameters.
4. What additional information should be included in the study report to more clearly demonstrate the basis for the study findings? There needs to be a validation of the results. Since one of the basic assumptions is that 40% of waste is reusable material then this should be reflected by decreased waste and decreased purchases for those sites that were visited. There is no way to capture these numbers to the exact amount, but there needs to be an analysis of DRMS information for the sites

visited, or review of the requisition history for these sites (or the units effected by the changed business practices).

Secondly, there must be a methodology proposed for the Army that will allow installations to collect financial information as HAZMAT control measures are instituted. The Navy had the dilemma of collecting financial data for sites as individual HAZMINCENS were opened across the service. Locations did not consistently collect the same financial data, nor was there even consistent nomenclature at the beginning. This study can propose solutions for the Army.

5. How can the study findings be better presented to support the needs of both the action officers and decisionmakers? Need to have a simple spreadsheet that the installations can use to come up with their own cost benefit analysis. TurboBPR is a good tool but it complex and easy to use only for the very experienced operator. What has been happening is that installations have been using the model (or having someone else use the model) and the model parameters are not fully understood by the installations. As an example, the case study in the draft report was used with installation data, but the results have been used to have a sister service provide HAZMAT management (with a surcharge) and funding was obtained to build more facilities. The results of the case study did take into account the cost of the new facilities and re-use was assumed to have no cost (no surcharge) in the TurboBPR assumptions. The case study installation is briefing return on investment results of 1.9 years and that these results are part of this study. The team never validated the results of this case study.

Overall, a user friendly spreadsheet that installations can use on their own will benefit the action officers at the installation and MACOM levels. Installations want these results, but without adapting the TurboBPR model assumptions and cost/benefit percentage breakdown then the results will be no good for the project officers.

6. How can the written material in the report be improved in terms of clarity of presentation, completeness, and style? The report is well written and very clear.

7. How can the figures and tables in the report be made more clear and helpful? The figures and tables are fine.

8. In what way does the report satisfy the expectations that were present when the work was directed? It meets the expectations of finding the benefits of HAZMAT control for the Army. It shows that HAZMAT control is beneficial for the Army.

In what ways does the report fail to satisfy the expectations? There are installations that want the product because they believe it will give them an answer about the cost of current HAZMAT business practices and also the benefit of changing the business practices. The study does not do this.

Report will satisfy all expectations with addition of a simple spreadsheet that lists assumptions so that the installations can easily modify the parameters. This will enable the installations to work out the several iterations of the ~~pharmacy concept~~ for their particular situation and develop the best fit. Currently at best the study will allow installations to compare themselves to the ~~average~~ installations of the model. These average installations do not exist anywhere.

9. How will the findings in this report be helpful to the organization which directed that the work be done? It will be helpful in demonstrating that HAZMAT control is beneficial for the Army.

If they will not be helpful, please explain why not. The study will not help installations determine the cost and benefits with out a lot of help in working with TurboBPR.

Unclear what the cost impacts and benefit impacts Percentage Breakouts really mean in the results of the report. When the ~~centralized issue/storage points~~ have a cost impact percentage breakout of 225% in Table 2-2 and a 0% benefit impact in Table 2-3 then is the conclusion already drawn that this initiative is not feasible ?

10. Judged overall, how do you rate the study?

Poor Fair Good Excellent

STUDY CRITIQUE

1. Are there any editorial comments? Yes If so please list on a separate page and attach to the critique sheet.

2. Identify any key issues planned for analysis that are not adequately addressed in the report. Indicate the scope of the additional analysis needed. (1) Cost and benefit findings are not necessarily applicable to current Army conditions. They are based primarily on Navy experience and an 8 year old GAO study. Significant change have been made to increase efficiency of Army materiel management in the past 8 years. Also, the Navy has few, if any, shore activities operating under CHRIMP. However, unless better data is available, additional analysis would not be beneficial. (2) Analysis of the impact of Pharmacy on Velocity Management is superficial. Study assumes that required materiel is always available in the Pharmacy and compares that to the time it would take to requisition materiel from a wholesale supply point if the materiel were not available at the users current supply point. It ignores considerations of Direct Vendor Deliveries and the manhours required by units to make special supply runs to the Pharmacy. Study should include an actual analysis of how implementation of Pharmacy would effect the using units. (3) Study concludes that Pharmacy will not adversely impact readiness. However, no data or analysis is included to support that conclusion.

3. How can the methodology used to conduct the study be improved?

Site visits do not appear to have included discussions with users as to benefits and problems of dealing with the pharmacy. Actual user experience would enhance the discussions of the costs, benefits and readiness impact.

4. What additional information should be included in the study report to more clearly demonstrate the basis for the study findings? If actual savings can be validated, the report should include documentation of that. If savings cannot be documented in terms of reduced disposal costs, fewer NOVs, etc, the report should revise it's findings to so state.

5. How can the study findings be better presented to support the needs of both action officers and decision makers? (1) Recommend you add a matrix displaying facts concerning how the sites visited operated, i.e, number of staff, how it is funded, where in the organization the pharmacy is located, which of the Pharmacy initiatives the pharmacy uses, whether Pharmacy services entire installation, etc. (2) Recommend you add a matrix summarizing the lessons learned at the sites visited that would be useful to an installation contemplating a pharmacy.

6. How can the written material in the report be improved in terms of clarity of presentation, completeness, and style? Not Applicable. Report is very well written.

7. How can figures and tables in the report be made more clear and helpful? Not applicable. They are very clear and helpful.

8. In what way does the report satisfy the expectations that were present when the work was directed? Report provides an excellent model of the considerations that need to be addressed in estimating the costs and benefits of establishing a pharmacy at an individual installation.

In what ways does the report fail to satisfy the expectations? Report was unable to provide new information to support Army wide decisions concerning pharmacy. The report cannot be used as a basis for policy or budget decisions because of non-availability of actual data concerning costs and benefits.

9. How will the findings in this report be helpful to the organization which directed that the work be done? Report provides a valuable break-out of Pharmacy initiatives and how likely they are to support the overall goals of Pharmacy.

If they will not be helpful, please explain why not. Not applicable.

10. Judged overall, how do you rate the study?

Poor Fair Average Good Excellent

Editorial Comments

1. Pg. 3-1, Para 3-2a, 5th line: Insert "have begun or" between "Navy shore activities" and "have implemented." Reason: To be consistent with facts presented in para.2-2a. Since so much of the data in the study is derived from Navy experience, it's important to note that very few, if any, Navy shore activities have an operating CHRIMP.

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30

GLOSSARY

1. ABBREVIATIONS, ACRONYMS, AND SHORT TERMS

ACSIM	Assitant Chief of Staff for Installation Management
ACTS	Army Compliance Tracking System
ADP	automated data processing
AEC	Army Environmental Center
ALCHMMI	Assessment of Logistics and Costs for Hazardous Materials Management Implementation (Study)
AMC	US Army Materiel Command
ATAV	Army Total Asset Visibility
AUL	authorized user/use list
CAA	US Army Concepts Analysis Agency
CASCOM	Combined Arms Support Command
CCAD	Corpus Christi Army Depot
CEAC	US Army Cost and Economic Analysis Center
CFR	Code of Federal Regulations
CHPPM	US Army Center for Health Promotion and Preventive Medicine
CHRIMP	Consolidated Hazardous Material Reutilization and Inventory Management Program
CIM	Corporate Information Management
COSCOM	corps support command
CRP	central receiving point
DCSLOG	Deputy Chief of Staff for Logicts

DISCOM	division support command
DLA	Defense Logistics Agency
DM-HMMS	Depot Maintenance-Hazardous Material Management System
DOD	Department of Defense
DODDAC	Department of Defense Automatic Addressal Code
DOL	Director of Logistics
DOT	Department of Transportation
DPW	Director of Public Works
DRMO	Defense Reutilization and Marketing Office
DSU	direct support unit
DYNCORP	DynCorp Aerospace Technology
ECAS	Environmental Compliance Assessment System
EMIS	Environment Management Information System
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act (1986)
FEA	Functional Economic Analysis
FISC	Fleet and Industrial Supply Center
GSA	General Services Administration
FORSCOM	US Army Forces Command
HAZMART	hazardous material pharmacy (Air Force)
HAZMIN	hazardous waste minimization
HAZMINCEN	hazardous minimization center
HAZWOPER	hazardous waste operations

HICS	Hazardous Inventory Control System
HM	hazardous materials
HMCC	hazardous material control center
HMIS	HM Information System
HSMS	Hazardous Substances Management System
HW	hazardous waste
IH	bioenvironmental
IMMS	Installation Material Management System
ISR	Installation Status Report
ISA	interservice support agreement
JIT	just in time
JPI	joint production instruction
lbs	pounds
LIA	US Army Logistics Integration Agency
MACOM	major Army command
MAJCOM	major command (Air Force)
MOU	memorandum of understanding
MSDS	material safety data sheet
NPV	net present value
NSN	national stock number
ODCSLOG	Office of the Deputy Chief of Staff for Logistics
ORISE	Oakridge Institute for Science and Education
OSHA	Occupational Safety and Health Administration

OST	order to ship time
PWC	Public Works Center
RADCF	resk-adjusted discounted cash flow
RCRA	Resource Conservation and Recovery Act
RHMMS	Regional HM Management System
SOP	standard of procedure(s)
SSA	supply support activity
TAIM	Total Army Inventory Management
TQM	total quality management
TRADOC	US Army Training and Doctrine Command
TurboBPR	Turbo Business Process Reengineering
OSHA	Occupational Safety and Health Act
VM	Velocity Management

2. DEFINITIONS

alternative

A set of related initiatives that improve performance and/or reduce costs.

constant dollars

Present costs normalized for inflation to a selected base year.

current dollars

Present the cost of the resources using estimated prices for the year in which the resources will be purchased.

discounted payback

The point at which the sum of the investment costs to date equals the sum of the cost impacts to date.

economic life

The period of time over which the benefits from an alternative are expected to accrue.

functional economic analysis

An analysis of functional process needs or problems, proposed solutions, assumptions and constraints, alternatives, life cycle costs and benefits, and investment risk analysis.

hazardous waste

Waste that, because of its quantity, concentration, or characteristics, may pose a substantial hazard to human health or the environment.

impact

The expenses for personal material consumed, support services, and other items that are charged annually or repetitively in the execution of a given project or program.

initiatives

Description of how improvement strategies can be accomplished.

net present value

The present value of a project's future cash flow was the present value of the investment in the project.

performance measure

A gauge that measures the accomplishment of goals.